Initial Draft

SOIL - HYDROLOGIC RECONNAISSANCE

of

Cascade Ranger District

Boise National Forest

July 1969

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PURPOSE

The purpose of the Soil-Hydrologic Reconnaissance Survey is to provide information for Ranger District Multiple Use Plans. It is an inventory of the soil and water resource. The basic unit of the survey is the land type. Land types are areas of land which have similar soil and hydrologic characteristics. These characteristics have been interpreted to identify the soil and water management hazards and other items such as limitations, suitabilities, and potential uses for related broad resource management and activity planning. This report provides an information base from which the land manager can make technically sound land management, decisions for definitive and manageable units of land.

DEVELOPMENT

A large portion of this report is based on information from the South Fork Salmon River Special Survey, Soils and Hydrology. 1/ One portion of this special survey was the soils and hydrology survey which included a reconnaissance land type soil association survey, stream channel system condition analysis, and sediment production analysis. Many of the methods, techniques, and principles used in this report were established in the soil and hydrology portion of the South Fork Special Survey. The South Fork Sepcial Survey included approximately two-thirds of the Cascade District. The remaining portion of the District was surveyed during the summer of 1968. The basic unit in both of these reports is the land type. Only minor changes were made for some of the delineated land types from the South Fork Special Survey.

APPLICATION

This report is designed to be used primarily at the District Multiple Use Plan level. It is a working tool to help the land manager make management decisions about specific areas of land. Other uses of the report are for broad resource and activity planning such as transportation and timber management planning.

This is a reconnaissance survey. It should not be used for specific project planning except in a very general way. As an example, this report should not be used to determine the suitability of a particular site for a campground, building site, recreation area, etc. Areas such as these, because of their small extent, require information beyond the scope of this survey. Following are some suggestions for the best use of this report:

1/ Arnold, John F., and Lloyd J. Lundeen, South Fork of the Salmon River Special Survey Soils and Hydrology, U.S.F.S., R-4, 1968. Report unpublished.

1. Read and study the report thoroughly. Get help if any part of the report is not clear or is not understood.

2. Check the report in the field. Become familiar with the land types and the soils that are described. Call attention to any apparent errors in mapping. Add your own comments and observations about how the various land types perform under certain management practices.

3. Correlate the report with the District Multiple Use Plan.

    a. Use the Land Type Soil Association Map as an overlay for the District Multiple Use Map.

    b. Use the land type descriptions to more clearly define existing management units.

    c. Use the Land Type Soil Association Map to adjust the multiple use management zone boundaries, where appropriate.

    d. Use report as a basis for making additional management decisions for management zones.

    e. List functional management considerations for each land type.

    f. Identify, describe, and write management decisions for land types or groups of land types which qualify for new management units.

4. With help from hydrology and soils personnel, develop interpretive maps for erosion and stability hazards for use in transportation and timber management plans. Develop other interpretive maps as needed.

5. Use report for broad resource and activity planning as procedures are developed.

6. Use the report as a basic document for continuing training program of District and Forest personnel.

7. Make additions or corrections as new data becomes available.

GENERAL DESCRIPTION OF THE DISTRICT

Location and Extent

The Cascade Ranger District encompasses approximately 245,000 acres of land within the Boise National Forest. The District is located entirely within. Valley County in west central Idaho. The eastern portion of the District lies within the South Fork of the Salmon River drainage. The southwestern portion of the District is drained by the Middle Fork of the Payette River and the northwestern portion of the District is drained by the North Fork of the Payette River.

Physiography and Relief

The Cascade District has been incised very deeply by the South Fork of the Salmon and the Middle Fork of the Payette Rivers. The elevation ranges from 8,700 feet at Rice Peak on the eastern boundary to approximately 4,500 feet on the northern boundary where the South Fork of the Salmon River leaves the District. Most of the District is between 5,000 and 7,500 feet in elevation. Except for Warm Lake Basin the District has very little flat land. A major portion of the land on the District has slopes steeper than 40 percent. Slopes steeper than 65 percent are common.

Glaciation and fluvial action (streamcutting) are the processes responsible for the shaping of the landscapes on most of the District. Faulting, structural control, and uplifting have also played an important, but less extensive role in the landforming processes of the District. As a result of these different processes the lands on the Cascade Ranger District have been divided into four major geomorphic groups. These groups are referred to as: (1) Strongly Glaciated Lands (2) Weakly Glaciated Uplands (3) Fluvial Lands and (4) Depositional Lands. These geomorphic groups are discussed in detail in the geomorphology section.

VEGETATION

In this survey vegetation was considered in terms of its effects on the hydrologic function of slopes. Particular attention was paid to the crown cover and ground cover density. These figures are shown for the various land types in Table 9, Appendix A.

There is a wide variety of vegetation on the Cascade Ranger District. Some species have a wide range throughout the survey area, however, the majority of species occur in communities which have a strong association with climate, soils and physiographic factors. The major associations are described briefly as follows:

A. Ponderosa pine association is mainly on steep dry stream cut slopes which have south and west exposures. This association is generally not found at elevations above 6,000 feet. Douglas-fir is often found in this association also. Generally associated with the open stand ponderosa pine are varieties of low brush, sagebrush and grass species. Some of the more common species are pine grass, bunch grass, ceanothis, snowberry, ninebark, service berry and willow.

B. Douglas-fir association is found mostly on the Fluvial Lands and the Weakly Glaciated Uplands. It is on the cooler moist north aspects and is commonly in combination with ponderosa pine with some areas having white fir, larch, lodgepole pine and Engelmann spruce. In this association the Engelmann spruce is in the more moist areas and the lodgepole pine in the cooler areas, or in areas which have been burned. This association has a dense overstory with moderately dense ground covers. Some of the more common understory species are elk sedge, tall huckleberry, ninebark, meadow rue, thimble berry, mountain maple, pine grass and buffalo berry.

C. Lodgepole pine association is found on moraines and other Depositional Lands along the valley bottoms that are subject to cold air drainage. This association may also be on high elevational exposed sites along with whitebark pine. This association, on glacial moraine deposits, has a thick canopy cover and a minimum of undergrowth. Understory is mostly dwarf huckleberry. When it is on the exposed high elevational ridge positions it generally is very sparse over extremely sparse ground covers.

D. Sagebrush grass association is on scattered areas, mostly along dry exposed ridge tops or sites similar to ponderosa pine association.

E. Subalpine association is at the higher elevations, above 6,500 feet on glaciated landscapes. The common tree species with this association are subalpine fir, lodgepole pine, whitebark pine and Engelmann spruce. Although there are many fortis and low shrub species on this association, the most common under-story species are elk sedge and low huckleberry.

There are many plant associations on the District, the above ones are the most dominant. There are also small areas of wet and dry meadow vegetation, some aspen and areas of pure brush stands. Many of these associations mentioned above are closely related. to specific land types. The vegetation for each land type is described in the land type descriptions.

CLIMATE 2/

Temperature

The District as a whole is characterized. by cold winters and warm summer days. The temperatures during the day time in summer may reach 100 degrees, but there is a marked cooling during the evening and night. Freezing temperatures may occur any day of the year at the higher elevations.

The only weather station on the Cascade District is at Cascade and temperatures from -40 degrees to 100 degrees have been recorded. Temperature extremes at higher elevations are probably even greater than these.

Precipitation

Precipitation varies considerably on the Cascade Ranger District from about 22 inches at Cascade to more than 50 inches at higher elevations and in headwaters of the major drainages. The prevailing winds bearing moisture are from the west. Cascade lies in the shadow of high mountains (West Mountain) and this may account for less precipitation at Cascade than on other parts of the District. The average annual precipitation at Cascade is 21.66 inches. The mean annual precipitation for the Cascade Ranger District is 37.5 inches calculated from the isohyetal map. The largest amount of precipitation is at high elevations in the east of the District. Much of the precipitation comes in the form of snow in the six month period October to March. Two thirds of the annual precipitation falls within this period. Figure 1.

Intense summer rainstorms are not uncommon in this area and as much as two inches may fall in short periods causing considerable runoff.

GEOLOGY

Bedrock

The Cascade Ranger District is located entirely within the Idaho Batholith. This is a large intrusive granitic batholith which covers about 16,000 square miles in central Idaho and western Montana.

According to the reconnaissance by Larsen and Schmidt,3/most of the rock

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2/ A detailed description of the climatic conditions on the east part of the Cascade Ranger District is given in the South Fork of the Salmon River Special Soils and Hydrology Report.

3/ Larsen, E. S., Jr., & R. G. Schmidt. 1950. A Reconnaissance of the Idaho Batholith and. Comparison With the Southern California Batholith. U.S.G.S. Bull. 1070-A, 33PP.

TABLE 1

Temperatures (Degrees Fahrenheit) at Cascade by Months

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL
Mean Temperature	18.9	23.7	29.1	40.1	48.3	54.3	63.1	60.9	53.5	44.0	31.0	23.1	40.8
Mean Daily Maximum Temperature	28.7	34.5	40.9	52.9	62.2	69.1	82.6	80.9	72.4	58.7	40.1	31.4	54.5
Mean Daily Minimum Temperature	9.1	12.9	17.2	27.3	34.3	39.5	43.6	40.9	34.7	29.3	21.9	14.9	27.1
Highest Temperature	48	55	64	79	85	93	100	96	95	85	60	49	100
Lowest Temperature	- 40	- 33	- 25	2	18	26	28	27	18	11	- 15	- 28	- 40

TABLE 2

Annual Precipitation, Deadwood Summit Storage Gage, Elevation 7000'

(Measurements taken about July 20 each year)

1955-1956	84.6 inches
1956-1957	68.1 "
1957-1958	66.1 "
1958-1959	56.1 "
1959-1960	68.5 "
1962-1963	86.6 inches
1963-1964	69.3 "
1964-1965	98.6 "
1965-1966	57.2 "
1966-1967	55.6 "

Average 71 inches

Figure 1

AVERAGE PRECIPITATION AT CASCADE, IDAHO, BY MONTHS

Precipitation October-March (14.54 inches) 67.12% Yearly Total

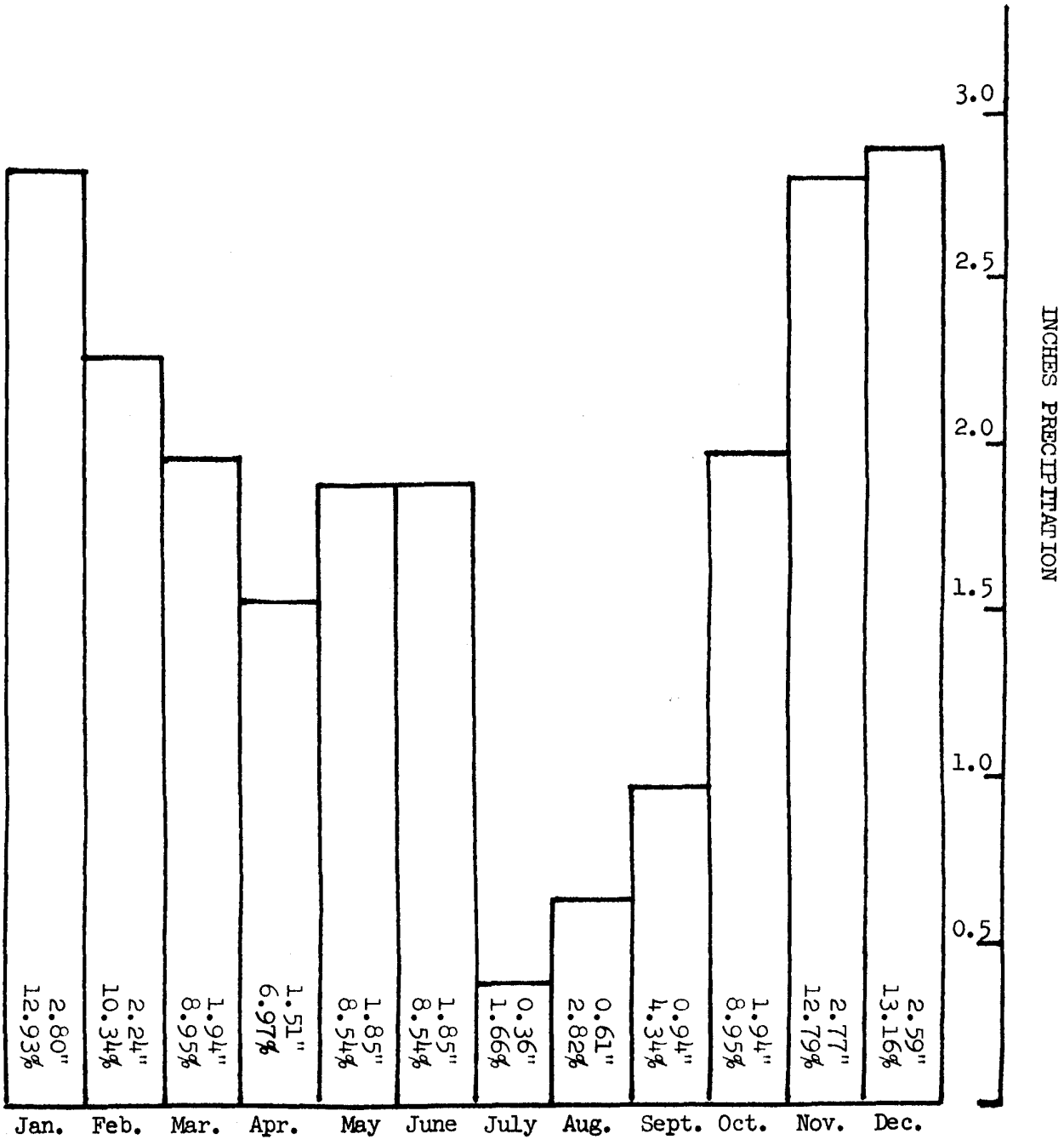


Photo 1

Photos 1 and 2 show the typical character of the quartz monzonite bedrock on the District. Note the accumulation of materials at the toe of the cut slope. This is typical of the spalling bedrock that is usually found in the Fluvial Lands Geomorphic Group. This rock can be described as moderately weathered, slightly fractured, and medium to coarse textured. Photo 2 is a closeup of the bands of feldspar and quartz called "pegmatites" which are common in these rocks.

Photo 2

in this area is a coarse to fine-grained monzonite with minor amounts of granodiorite and quartz diorite. The texture of the quarts monzonite is dominantly coarse to medium-grained. Veins and dykes of fine-grained rocks (aplites) and extremely coarse-grained rocks (pegmatities) are common. The aplites are apt to be more highly weathered than adjacent rock. Quartz monzonite in its unaltered form weathers mostly by mechanical disintegration. The rock weathers into coarse sands and fine gravels which have the same composition as the original rock. Often the upper several feet of this rock may be easily dug into with a shovel or other tool. The rock in its weathered form looks almost identical to the unweathered rock, in that the rock structure, texture and colors have not changed significantly with the weathering process, only its hardness is changed. Roots will penetrate this material almost as readily as they will the soil. Below the weathered zone the roots are generally confined to fractures and other zones of weakness. In some places the quartz monzonite has been altered by the thermal activities and subsequent solutions. In these areas the weathered zone may be as thick as ten to twenty feet. The rock in these areas generally is tan to brown and usually is finer textured than the unaltered quartz monzonite The soils formed from these materials are somewhat finer textured than they are from the unaltered quartz monzonite.

Granodiorite is almost indistinguishable from quartz monzonite without the use of magnifying instruments. Granodiorite is a medium to coarse grained light gray rock. The laminar structure generally is less conspicuous than it is in the quartz monzonite rock. Except in canyons and other deeply dissected or faulted areas, granodiorite is deeply weathered. The weathered portion of the rock has a pattern of brown to gray colors. The degree of weathering in the granodiorite is irregular, however, most of the rock can be dug into with hand tools.

Quartz diorite is somewhat finer textured and darker colored than is quartz monzonite or granodiorite. The weathering of quartz diorite is such that solid rock is very rare. On exposure the rock disintegrates readily into medium, fine yellowish micaceous sands. The hardness of the weathered rock is similar to that of altered quartz monzonite.

The degree of weathering is strongly associated with the broad geomorphic groups of land types which have similar genesis. The bedrock in the Fluvial Lands,for instance,is moderately to well weathered and subject to spalling upon exposure to the atmosphere. The rocks in the Strongly Glaciated Lands are consistently harder and fresher and generally more highly fractured than those at lower elevations in the Fluvial Lands. Rocks also tend to be harder along the main canyons and some of the minor drainages where the streams are entrenching along the fault lines. The bedrock in the Weakly Glaciated Uplands are generally moderately to well weathered. The reason for the above differences in weathering is the time lapse for the weathering processes to act. The bedrock in the Strongly Glaciated Lands have largely been stripped of the overlying

softer rocks by the glacial action and the rocks now exposed have been exposed for a much shorter period of time.

Because granitic rocks of the Idaho Batholith are difficult to classify properly in the field, and because other than mineralogical properties are often more important in the interpretation of how a slope will perform, a more subjective description of the bedrock is helpful. A key4/ for the description of granitic bedrock char-acteristics is found on page 11 This key has been used in this report as a guide in the classification and interpretation of the bedrock characteristics on the District.

Structure

Understanding the geologic structure of an area is important because it establishes the frame of reference with which the geologic forces,past and present, can best be understood. It is commonly accepted that the main Idaho Batholith was emplaced about one hundred ten million years ago during the middle Cretaceous geologic period. This was followed by periods of deformation and metamorphism. How much overburden of other rocks has been stripped away since emplacement is unknown. Much of the control that the South Fork of the Salmon Drainage exhibits has occurred since early Pleistocene period. The block fault which forms the Warm Lake Basin extended its fault line the entire length of the present South Fork of the Salmon River to, and perhaps beyond, the junction with the East Fork of the South Fork of the Salmon River on the Krassel District. Minor faults along the main drainage are responsible for the establishment of the drainage patterns of the tributaries of the South Fork of the Salmon and are also responsible for the dominant jointing planes being nearly parallel to the slope on South expostures of the east flowing drainages. It is along these major and minor fault lines that rocks with case hardened surfaces are found. This hardening is a result of pressures associated with faulting activities. (See Photo 6)

GEOMORPHOLOGY

The landforms in the survey area are representative of those found in the contiguous areas within the Idaho Batholith. Some of these processes are very obvious, some of them not so obvious. Landforms which are the result of glaciation are generally quite distinct and are readily identified as such. Also lands which are well along in the fluvial cycle are easily recognized. The landforms which have resulted from geomorphic processes such as weak glaciation, (periglaciation) mass wasting, faulting, uplift, aeolien deposits and combinations of these are much harder to recognize and are less conspicuous. It is seldom that a landscape or landform can be found that is the result of one single geomorphic process acting alone.

4/ Arnold, John F. 1969. A Descriptive Key to Granitic Rocks, U.S.F.S. R-4 Report (unpublished)

DESCRIPTIVE KEY FOR GRANITIC ROCKS

		Distance between Fractures
Fracturing:	1. Massive	6 Feet
	2. Slightly Fractured	4-6'
	3. Moderately Fractured	1.5-4'
	4. Well Fractured	
	5. Extremely Well Fractured	<5

Weathering: 1. Hard, Unweathered

2. Moderately Hard, Somewhat Weathered (Non-Spalling)

3. As Above but Spalling

4. Moderately Soft - Moderately Weathered (Fracturing often Masked)

5. Soft - Well Weathered (Roots often Penetrate between Fractures)

Texture: 1. Fine Grained

2. Medium Grained

3. Coarse Grained to Porphoritic

Color: 1. Very Light Brownish to Whitish

2. Grayish

3. Light Brownish

4. Brownish to Redish

5. Dark Brownish to Redish

Dominant Jointing Plane (Where Important).

See footnote 4 page 1.0

Photo 3

This photo shows the mechanical disintegration of granitic bedrock. This is known as air slacking, spalling or more correctly as granular exfoliation. This weathering process is caused by fluctuation in temperature and moisture and as is shown in Photo 3, gradually reduces and rounds exposed bedrock.

Photo 4

The bedrock in this photo can be described as slightly fractured to massive, moderately hard, somewhat weathered and spalling. This is a typical example of a rock cropout in the Fluvial Lands.

Photo 5

Using the Descriptive Key the bedrock in this photo can be described as moderately fractured, hard and unweathered. This is typical of the bedrock found in the Strongly Glaciated Lands Geomorphic Group. Notice the stable road cut.

Photo 6

The bedrock in this photo can be described as being extremely well fractured, hard, unweathered and nonspalling. This bedrock is common in the Strongly Glaciated Lands. It is also common in areas were faulting has occurred.

Photo 1

The bedrock in this photo was described an being moderately to well fractured, moderately soft and moderately weathered. The fracturing in this bedrock is masked by the weathering. This is typical of one type of granitic bedrock found in the Fluvial Lands. Road fills constructed with this material are often unstable because of the poor gradation of particle sizes.

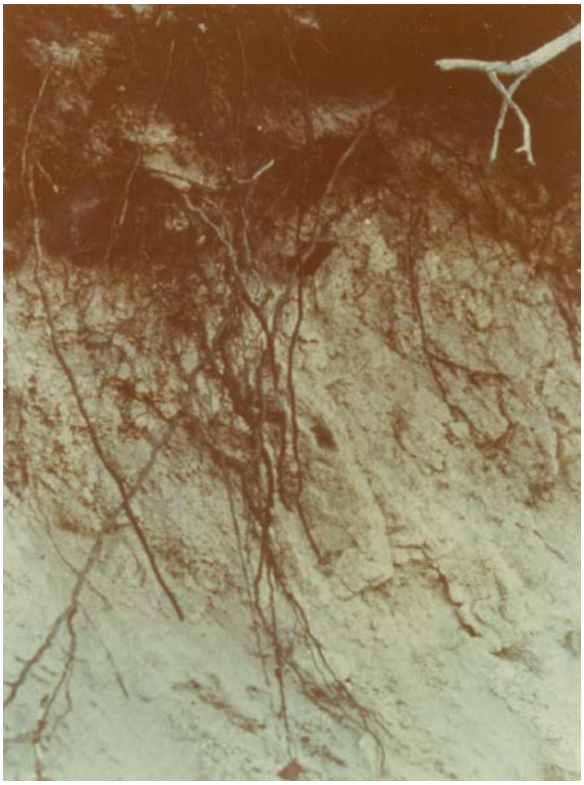


Photo 8
The bedrock in this photo is and example of well fractured, soft and well weathered granitic bedrock Note the root penetration.

Photo 9

This photo shows three of the broad geomorphic groups referred to in this section. The foreground is an example of a moderately dissected mountain slope found in the Fluvial Lands geomorphic group. The center of the photo is an example of the Weakly Glaciated Lands. Note the more gentle slopes and the rounded subdued topography. The background shows the Strongly Glaciated Lands geomorphic group. The barren sharp rocky ridges and rugged mountain peaks are typical of the lands found in this geomorphic group.

Land types are the basic mapping units for the Soil Hydrologic Reconnaissance Survey. These land types have been grouped into four broad geomorphic groups. These groups are termed Strongly Glaciated Lands, Weakly Glaciated Uplands, Fluvial Lands, and Depositional Lands.

The Strongly Glaciated Lands occur at elevations over 6,000 feet on the District. These lands have been shaped by alpine glaciation and are characterized by straight U-shaped glacial valleys which generally have a parallel drainage system. Other landforms associated with Strongly Glaciated Lands are cirque basins, headwalls, rocky ridges and weakly expressed horns.

The Weakly Glaciated Uplands are located below the Strongly Glaciated Lands or adjacent to them. In the Weakly Glaciated Lands the effects of ice and permanent snow field action were mainly localized. The soil and rock materials were not carried by major ice currents as in the case of the Strongly Glaciated Lands which caused the U-shaped valleys. As a result the lands have subdued topography. The slopes are somewhat more gentle and are mostly convex in shape. The ridge tops are rounded and subdued as compared to the sharp rocky ridges found in the Strongly Glaciated Lands. In most cases the Weakly Glaciated Lands have weakly expressed drainage development. This is due partially to the localized grinding action of the snow and ice fields and partially to the dominant kinds of slope-forming processes presently active in these slopes. Weakly glaciated landscapes are at elevations where nivation, freezing, thawing, wetting, and drying, make mass wasting the chief process by which materials are moved downslope. These processes keep replacing materials which may have been removed by overland flow.

The Fluvial Lands are usually at elevations less than 6,000 feet. These lands are characterized by steep V-shaped valleys and a strongly expressed drainage system. The dominant geomorphic process active on most of these lands is the erosive force of running water. The process of fluvial action by streamcutting, however, is not the only process which is active in this broad geomorphic group. Mass wasting, uplift, faulting, and structural control have also contributed to the shape of these lands. This is particularly evident in the lands that are immediately adjacent to the South Fork of the Salmon River. These lands, as a result of faulting activity, and subsequent uplifting, have been over-steepened and subsequently have been strongly dissected and have extremely steep slopes. Erosion on dissected mountain slopes tends to be cyclic. Draws and depressions are slowly filled by mass wasting processes. This material is then poised for movement by such climatic events as rain on snow and high intensity storms.

Depositional Lands are the lands which were formed by water and glacial deposits. These lands occur throughout the District and in all of the geomorphic groups. Except for the Warm Lake Basin area the Depositional Lands are of a very minor extent on the District. These lands occupy the bottom of the U-shaped glacial troughs, the stream terraces adjacent to the South Fork of the Salmon River and moraines and glacial outwash

Photo 10. This photo shows a landscape near the top of West Mountain that has been altered by eolian (wind deposited) materials. The rock outcrop in the extreme left and upper center of the plot is basalt. This is one of the few places on the District that basalt outcrop was observed.

Photo 11. This photo shows a soil on West Mountain that has been altered by eolian deposits, This soil is about 30 inches deep over granodiorite. Textures are fine sandy loam over sandy loam.

areas near the margins of the Strongly Glaciated Lands.

Detailed descriptions of the land types in these geomorphic groups are described in the section on Land Type Descriptions.

SOILS

The soils of the District have been classified and described according to the criteria established in the Comprehensive Soil Classification System. The soils have been classified to the soil family level. Soil families are differentiated primarily on the basis of properties which are important to the growth of plants. Differentiating criteria are not the same for all categories in the classification system but primarily include texture, minerology, reaction, soil temperature and depth. Table 13 in Appendix B gives the classification of the soil to the family and at the higher categories of the classification system.

A common characteristic of the soils on the District is their youthful appearance. This is expressed by weak horizon development and coarse textures. The soils are very young in terms of geologic age. In a large part of the District the landscape is in the mature stage of the fluvial cycle. It is at this stage of the fluvial cycle that the geologic erosion processes are most active. Therefore, the soil materials are not in lace long enough for the soil forming processes to act upon them. This is why the soil textures are fairly uniform throughout the soil profile. This is also the reason for the weak horizon development in most of the soils on the District.

Landform has strongly influenced the development of the soils on the District. Slopes generally have three segments. (1) areas of soil loss, (2) the transitory part of the slope where gains in soil materials equal losses and, (3) the part of the slope where materials accumulate. These three parts of the slope correspond to ridge tops and upper side slopes, the straight side slopes and the last position, the concave toe slopes and swales. Slope shape, therefore, controls two important features of the soil: Soil depth and soil moisture. Shallow droughty soils are more common on convex positions and deep, moist soils are more common in concave positions such as swales. The most strongly developed soils are in the concave accumulative positions.

The soils formed on the different types of granitic rock on the District are quite similar; however, some minor differences were noted. The soils from granodiorite and quartz diorite have slightly finer textures, finer sands, and micas are more conspicuous than in the soils from quartz monzonite. The soils from the quartz monzonite generally have loamy coarse sand textures.

The only soils on the District which are not formed entirely from granitic bedrock were found on West Mountain, west of Cascade. These soils have been formed mostly from granitic bedrock but have been altered somewhat by basaltic alluvium and in some areas by a thin layer Of eolian(wind deposited) material. (See Photo 10 and 11). The soils in this area have finer textured surface horizons than soils in other areas of the District. Fine sandy loam is a common surface texture for the soils on West Mountain. The subsurface horizons of the soils in this area are sandy loamy to loamy sands, similar to the soils on the rest of the District.

Other factors which affect the appearance of the soils on the District are vegetation, animal activity, and climate. The thickness of the surface horizons is generally related to the amount and type, of organic matter deposited by the vegetation growing on the soils. Soils which have the thickest surface horizons generally support dense stands of brush or herbaceous vegetation. Soils under conifer stands generally have thinner surface horizons. Thin surface horizons are also found on very warm slopes where oxidation of organic matter is rapid. Vegetation also retards surface erosion resulting in the formation of thicker surface horizons.

Rodent activity on some open weakly glaciated slopes have mixed organic surface materials with substrata materials and have had the affect of thickening surface horizons.

Climate is one of the most important formative processes in the development of soil. No soil development would be possible without the effects of moisture and temperature. The fluctuations of temperature, with the resultant freezing and thawing, are basic processes by which parent rocks are broken down into smaller particles. The major soil profile characteristic attributable to climate, is the color of the subsoil in the Strongly Glaciated Lands and the Weakly Glaciated Uplands. The color of the soil on these lands is brighter (higher in chroma)than the soils on the warmer sites of the Fluvial and Depositional Lands.

HYDROLOGY

Stream Channel Characteristics and Condition

Intensive resource use has resulted in an increase in the sediment load of many stream channels. Usually the small streams in the headwaters of a drainage where there has been little or no resource use are in excellent condition. At lower elevation where there has been more resource use and soil disturbance the rating is much lower. Road construction has been the major cause of the sediment increase. Aquatic habitat has been damaged and some stream bank erosion has occurred where there has been resource use near or adjacent to the streams. Several

land types have naturally high sediment rates. The land types with the highest sedimentation rates are units 120d, 122 and 112.

A stream condition aquatic habitat survey was made on the thirteen major streams, of the Cascade Ranger District. Seven of the streams were tributaries to the South Fork of the Salmon River in the eastern part of the District. Three streams flowed into the North Fork Payette River and three small streams on West Mountain flowed into Cascade Reservoir.

The information collected on sample streams will be useful to determine what effects proposed use will have on these particular streams. The field sample sheets and the aerial photos showing locations of the samples will be kept on file for future reference and determination of future channel conditions at these same sites if the need arises. The channel condition extrapolations will provide a source of data showing most probable present channel condition on the unsampled streams.

The stream channel condition survey was designed to collect other information anticipated to be useful for hydrologic and aquatic habitat purposes. This is not presented herein but includes data for making rough estimates of peak flows, riffle-pool ratios, stream bottom composition, stream bank characteristics, and a brief description of the potential of the stream as a fishery. Table 5 and Photo 12 give an example of the information collected at each sample site.

Mormon Creek - This stream is in a depositional type bordered by strongly glaciated land. There has been some resource (timber) use in the lower part of the drainage with heavy grazing use in the past on the open slopes. The upper part of the drainage is in excellent condition. The lower portion is fair to poor due mainly to deposits of sediment and bank erosion.

Rice Creek - This stream is in a, depositional type land with strongly glacial land nearby. Use has been similar to Mormon Creek with heavy sheep use on the open slopes and some logging in the lower reaches of this drainage. The channel condition in the upper part of the drainage is excellent. In the lower part the condition is poor.

Tyndall Creek - This stream flows through dissected mountain slope land. There has been some sheep grazing use on the open slopes in the upper part of the drainage. Several years ago the livestock grazing use was eliminated. The stream condition in the upper part of the drainage is good to excellent and fair in the lower part of the drainage.

Trail Creek - From Big Creek Summit, Trail Creek flows through Strongly Dissected Mountain Slope Land, then through Moderately Dissected Thin Mantled Mountain Slope and into Strongly Dissected Thick Mantled Mountain Slope Land. Except for the upper part, which is a very small stream, the condition of the stream is poor to very poor. Road construction and

logging adjacent to, or near the main stream channel have caused deterioration of the stream.

Curtis Creek - The upper part of Curtis Creek flows through Alluvial Lands with Weakly Dissected Mountain Slope Land to the west and Moderately Dissected Mountain Slope Land a short distance east. The lower part of the stream flows through Strongly Dissected Mountain Slope Land. There has been considerable resource use (logging) near the stream and the condition is fair to poor.

Campbell Creek - This creek is the municipal water supply for Cascade. From Rocky Ridge Land in the headwaters it flows through Cirque Basin Land and Weakly Dissected Mountain Slope land. In the past there was heavy sheep use on the open areas in the upper part of the watershed. This was discontinued about eight years ago. The condition of this stream varies from good to excellent.

Hazard Creek - This stream is an auxiliary water supply for the city of Cascade. A ditch has been constructed near the lower part of the drainage to divert water into the Cascade supply when it is needed. From Rocky Ridge Land in the headwaters it flows through Depositional Land and then Weakly Dissected Mountain Slope Land. There was heavy sheep use in the past on the open areas near the headwaters. This use was discontinued eight years ago. The stream condition varies from fair to excellent.

French Creek - French Creek flows from West Mountain into Cascade Reservoir. The upper part of the stream flows through Weakly Dissected Glacial Trough Lands and the lower part through Moderately Dissected Mountain Slope Lands. The open areas in the upper part of this drainage have received heavy sheep use in the past. The livestock use was discontinued about eight years ago. The stream condition is good to excellent.

Gold Fork - Gold Fork flows through Weakly to Moderately Dissected Mountain Slope Lands and some glacial lands in the upper reaches. The lower part of this drainage has been extensively developed by roads and logging. There has been considerable amounts of sediment moving down the tributaries and main stream channels. The stream condition is fair to poor.

Big Creek - Big Creek flows through Moderately Dissected Mountain Land, with Depositional Land near the lower part of National Forest land. There has been some resource use near the lower portion of the stream. Big Creek carries considerable bed load sediment.

Clear Creek - The upper part of the Clear Creek drainage flows through Moderately Dissected Mountain Slope Land. The lower part is strongly Dissected Thick Mantled Mountain Slopes and Alluvial and Depositional Land near the Forest Boundary.

There has been considerable resource use (logging) in the lower part of this drainage. The stream carries a considerable amount of sediment. A stock driveway follows the drainage on the north side but has not been used for the past seven years. The stream condition varies from good to poor.

Water Yield - Data is available from six stream gages located on or near the Cascade Ranger District. Data from these stations is shown on Table 3. Water yield estimates for each land type are given in Table l0 Appendix A.

The average water yield for the part of the Cascade Ranger District drained by the South Fork Salmon River is 21 inches. For the Gold Fork River drainage, the average yield is 21.72 inches. That part of the Cascade Ranger District draining into the North Fork Payette River yields approximately 19.4 inches. There are no stream gages on the Middle Fork Payette River. It is estimated that the portion of the Cascade Ranger District which drains into the Middle Fork Payette River yields 19.5 inches of water.

The average water yield for the Cascade District is 19.80 inches. This amounts to 52.8 percent of the average annual precipitation. Peak flows on streams in the Cascade Ranger District can usually be expected from snow melt and will normally occur the latter part of May or first part of June. Peak flows on the larger streams and tributaries are shown in Table 4.

Photo 12

A photograph was taken at transect No. 3 of each sample site. This photograph helps illustrate conditions existing within the reach, and also serves as a help to relocation of the sample sites if re-measurement of the sample areas is desired.

TABLE 3
Run-Off-Surface Water

Station	Period of Record	Drainage Area Sq. Mi.	Annual Yield Acre Feet	Yield Per Acre	Peak Flow CFS	Date
So.Fk.Salmon R. near Knox	1928-1960	92	105,000	1.78	1,560	6/9/33
So.Fk.Salmon R.near Krassel R.D.	1966-1967**	330	391,000	1.85	3,840	5/24/67
Gold Fk. R. near Roseberry	1920-1921					
	1961-1967	143	165,800	1.81	2,260	5/20/21
No.Fk.Payette R. near Cascade	1941-1967	626	736,300	1.83	7,320	5/10/47***
No.Fk.Payette R. near Van Wyck	1912-1925*	608	690,666	1.77	-	-
No.Fk.Payette R. near Smiths Ferry	1941-1947	893	923,166	1.62	9,110	6/3/43

* Complete record for three years only.
** Only one year's record
*** Flow in No. Fk. Payette Riv. is regulated at the Cascade Reservoir. Storage began Nov. 7, 1947

TABLE 4
Snow Course Summary

Location	No. Years Record	January 1 Snow Depth (inches)	January 1 Water Content (inches)	February 1 Snow Depth (inches)	February 1 Water Content (inches)	March 1 Snow Depth (inches)	March 1 Water Content (inches)	April 1 Snow Depth (inches)	April 1 Water Content (inches)	May 1 Snow Depth (inches)	May 1 Water Content (inches)
Crawford Ranger Station, Elev. 4800 ft.	43	12	2.6	97	31.4	24	7.2	17	6.3	0	0.0
Big Creek Summit Elev. 6600 ft.	34	56	16.0	77	23.2	90	30.5	93	35.2	80	35.5
Greenfield Flat Elev. 7370 ft.	9	58	16.5	84	26.0	99	34.5	122	42.2	101	43.9
Deadwood Summit Elev. 7000 ft.	34	83	24.0	97	31.4	120	40.3	114	44.8	100	46.1

TABLE 5

COMBINED STREAM CONDITION - AQUATIC HABITAT FIELD DATA SHEET FOR RECONNAISSANCE SOIL-HYDROLOGIC SURVEY

Forest Boise **Stream & Reach** Gold Fork **Date** 10/28/68

Gradient 2% **Velocity** Mod. 2ft/sec. **Aerial Photo** ELD-13-56

Sample No. IV

	ITEM (Name)	(No.)	TRANSECT NO. 1	2	3	4	5	Ave.
SURFACE	Width - Surface / High Water	1	32/42	42/54	33/35	37/37	32/34	35/40
	Depth	2	7	15	11	9	8	10in
	Riffle Width	3	32	22	22	37	25	27.6
	Pool - Width	4		20	11		7	6.8
	Pool - Rating	5		4	3		5	4
	Pool - Origin	6		Log	Boul-der		Log	
BOTTOM	Aquatic Plants - Type / Amount	7	C/5	C-R/5	C-R/20	C/25	C/5	C-R/12%
	Boulders - > 36"	8	0	2	0	0	0	1%
	Rubble - 12 - 36"	9	0	3	4	6	3	9%
	Cobbles - 4 - 12"	10	10	18	3	27	9	38%
	Gravels - 1/8 - 4"	11	20	12	21	2	7	35%
	Sand - < 1/8"	12	2	6	3	2	13	15%
	Other	13	0	Log 1	Log 2	0	0	2%
	Roughness Factor 1/	14			035			

1/ For 3rd transect only.

Reverse side of form (Combined Stream Condition - Aquatic Habitat Field Data Sheet for Reconnaissance Soil - Hydrologic Survey.

	ITEM (Name)	(No.)	TRANSECT NO. 1	2	3	4	5	
STREAM BANK Left Bank	Cover	15	3	3	2	2	2	Brush / Grass
	Condition - Vegetation Index / Value as Fish Cover	16	3/5	3/5	3/5	5/4	1/4	3/5
	Type - At Point / General ± 100 feet	17	3/3	2/3	2/2	2/2	1/2	2/2
	Erosion (Present)	18	2	3	2	2	10	2
	Stream Influence Zone							
	Bank Materials Erodibility	19	3	3	3	1	3	3-1
	Effective Depth	20	2	3	2	3	4	
	Land Type	21	D	D	D	D	D	
STREAM Right Bank	Cover	22	3	2	5	2	4	2-5
	Condition - Vegetation Index / Value as Fish Cover	23	3/5	5/5	8/5	1/4	6/5	1-8/5
	Type - At Point / General ± 100 feet	24	5/5	2/4	4/4	2/2	3/2	2-5/2-5
	Erosion (Present)	25	10	2	1	10	2	2-10
	Stream Influence Zone							
	Bank Materials Erodibility	26	3	3	1	3	3	3
	Effective Depth	27	2	2	4	2	2	
	Land Type	28	D	D	D	D	D	
Miscellaneous	Resource Uses	29	B	B	B	B	B	
	Estimated Channel Condition	30	17	18	17	16	17	17
	Est. Fisheries Hab. Rating	31	4	4	3	3	4	3-4
	Sinuosity	32		1.00	1.02	1.05	1.05	
	Remarks	33						

This stream is adjacent to the main road and much material and debris has been pushed into the stream. Fine and coarse sand is found on the bottom and behind rocks and other obstructions. Many holes and pools have sediment in them. Very little acquatic vegetation. Pools are shallow and there is little cover. This stream is poor fishery habitat.

AQUATIC HABITAT

To be written.

SEDIMENT

Detailed information concerning sources and causes of sediment production for this area is contained in the report for the South Fork of the Salmon River Special Survey. 1/ Summary information from this report is contained in the following tables:

TABLE 6
ESTIMATED NATURAL SEDIMENT PRODUCTION FROM STREAM CHANNEL EROSION IN THE DEPOSITIONAL LANDS

Stream Order Number	Miles of Channel	Annual Channel Erosion Rate Cu.Yds/Miles	Total Annual Sediment Cu. Yds.
1	129.6	3.9	505.4
2	149.0	17.0	2533.0
3	105.5	22.2	2564.2
4	63.2	68.0	4365.6
5	15.2	92.6	1407.5
6	8.0	111.0	888.0
7	0	-	-
8	0	-	-
Total	470.5	-	12,263.7

Some of the drainages listed under Number one are ephemeral or intermittent streams and will produce (transport) only a small amount of sediment in relation to the total production from all streams.

See footnote 1, page 1

TABLE 7 ESTIMATED MEAN ANNUAL NATURAL SEDIMENT PRODUCTION BY LAND TYPES 1/
FROM MOUNTAIN SLOPES

Land Type	Symbol	Area in sq.Miles	% of Area	Est.Sed.Prod. in Cu.Yds/Sq. Mi/Yr.	Total Mean Ann.Sed.Prod Cu.Yds.	% of Total Sed.Prod.
Toe Slope Land	107	1.77	.5	15	26.5	.2
Glacial Plastered Mountain Slope Land	108	20.27	5.3	10	202.3	1.6
Weakly Glaciated Uplands	109	28.80	7.6	10	288.0	2.3
Thin Mantled Weakly Glaciated Uplands	109a	14.00	3.7	35	490.0	4.0
Moderately Dissected Weakly Glaciated Uplands	109b	14.92	3.9	30	447.6	3.6
Cirque Basin Land	110	6.17	1.6	3	19.4	.1
Scoured Cirque Basin Land	110x	6.70	1.8	5	33.5	.3
Weakly Dissected Glacial Trough Land	111a	15.37	4.0	10	153.7	1.2
Moderately Dissected Glacial Trough Land	111b	18.27	4.8	15	274.0	2.2
Strongly Dissected Glacial Trough Land	111c	10.13	2.6	50	506.5	4.0
Steep Rocky Cirque Head Land	111d	4.44	1.2	75	333.0	2.7
River Spur Land	112	.19	.1	100	19.0	.1
Rocky Ridge Land	113	15.52	4.0	5	167.6	1.4
Subalpine Rim Land	114	8.82	2.3	10	88.2	.7
Glacial Scoured Mountain Slope Land	115	.81	.2	35	28.4	.2
Weakly Dissected Mountain Slope Land	120a	16.08	4.2	15	151.2	1.2
Moderately Dissected Mountain Slope Land	120b	56.90	14.9	25	1,422.5	11.6
Moderately Dissected Thin Mantled Mountain Slope Land	120b-1	32.07	8.4	50	1,603.5	13.5
Strongly Dissected Mountain Slope Land	120c	23.05	6.0	100	2,305	18.9
Strongly Dissected Thick Mantled Mountain Slope Land	120c-1	8.17	2.1	75	612.7	5.0
Steep Rocky Head Land	120d	6.77	1.7	125	936.3	7.6
Maturely Dissected Mountain Slope Land	120e	14.16	3.8	20	283.2	2.3
Steep Maturely Dissected Mountain Slope Land	120e-1	8.60	2.2	40	344.0	2.3
Structural Basin Land	121	.63	.2	15	9.4	.1
Maturely Dissected Structural Basin Land	121e	2.80	.7	20	56.0	.5
Oversteepened Canyon Land	122	6.90	1.8	200	1,380.0	11.4
Faulted Bench Land	123	6.66	1.7	20	133.2	1.0
TOTAL		348.97	91.3		12,314.70	100.0

1/ Does not include sediment from Depositional Land types (see Table 8).

TABLE 8

ESTIMATED ANNUAL SEDIMENT PRODUCTION BY PERCENT FROM VARIOUS SOURCES IN THE SOUTH FORK SALMON SURVEY AREA

Contributing Source	% of Total Annual Sediment Production
Natural	
Mountain Slopes	13.2
Stream Channel Cutting	10.4
Total Natural	23.6
Accelerated	
Main Roads	
Surface Erosion	10.9
Debris Slides	5.4
Logging Roads	
Surface Erosion	38.1
Debris Slides	10.9
Skid Trails	4.4
Logging only	3.3
Livestock Grazing and Trailing	1.1
Fire	.1
Wildlife	Trace
Other	2.2
Total Accelerated	76.4
	100.00

MANAGEMENT RELATIONSHIPS

This section discusses the management relationship of the significant features of the landscape to water, timber, road construction, recreation, range, and wildlife. These various functional resource activities are related to soils, land type, character of bedrock and other significant
landscape features.

WATER

Most soils on the District have very high infiltration and percolation rates. They also have, because of their coarse textures, low water-holding capacities. They readily take in and transmit water. Unless the soils are disturbed, surface runoff is rare on much of the District, except when very high intensity storms occur. Thus, much of the moisture that falls on the slopes is delivered to the stream as subsurface flow rather than surface flow. This is true on most of the lands in the District, except for certain areas in the Fluvial Lands where surface flow is dominant.

The character of the bedrock is an important factor in the transmitting of moisture. Well weathered and/or well fractured bedrock has the capacity to store and transmit water as does the soil. In areas of land where the bedrock tends to be well weathered and/or well fractured, subsurface flow is dominant.

Where the bedrock is massive and not so well weathered, surface flow tends to dominate. However, in areas of massive bedrock, subsurface flow is still a factor. Water that has percolated down through the soil flows over the surface of the massive or slightly fractured bedrock. This is known as the subsurface flow interface. When roads or contour trenches are built on these lands, the subsurface flow interface may be intersected and the subsurface flow is converted to surface flow. This increases soil loss by erosion of the road surface and may weaken fill slopes by saturation. The danger of intersecting the subsurface flow line is quite high on the warm south-facing slopes in the Fluvial Lands. Land types where this condition is most prevalent are Oversteepened Canyon Lands, Rocky Headlands, and Dissected Mountain Slope Land.

Bedrock that is deeply weathered and/or highly fractured permits moisture to penetrate deeper than the massive bedrock. The chance of intercepting large amounts of subsurface flow in lands with these types of bedrock is therefore much less. Lands which have these types of bedrock are the Strongly Glaciated Lands where the bedrock is well fractured, and the Weakly Glaciated Lands which have deep soil mantles and well weathered bedrock.

The shape of the land and the drainage pattern also tells something about how it handles the moisture that falls on it. Lands which have weakly expressed drainage systems as we find in the Weakly Glaciated Lands and in most areas of the Strongly Glaciated Lands, indicate that there is very little surface flow. These lands are percolating water

quite deeply and are releasing the water slowly. These lands are responsible for maintaining stream flow through the dry periods of the year. Lands which are deeply incised with a dendritic stream pattern indicate that the bedrock is impermeable and that water is moving mostly as surface flow. These lands store very little water and thus do not contribute to sustained stream flow. Much of the area in the Fluvial Land is of this type.

It is important to understand how a slope transmits water. The relationship that exists between the shape of the land and the way it transmits water is a very strong one, but also a very delicate one. It is a balance which is easily disrupted by engineering practices such as road construction, contour trenching, and ditching. As nearly as possible, we should not interfere with the natural way a slope is transmitting water. If, as a result of engineering practices, we increase the infiltration of water into the soil mantle, we are increasing the potentials for mass failure and decreasing the surface erosion potentials. If we concentrate the surface runoff and intercept subsurface flow into drainageways, we are decreasing the potentials for mass failure but increasing the potential for surface erosion.

TIMBER

A site index range for ponderosa pine and Douglas-fir is given for the soils that are identified on the District in Table 12, Appendix B. These ranges are quite broad. The effect of the bedrock characteristics appears to be as important to site quality as the characteristics of the soil profiles.

The characteristics of a soil profile which influence tree growth are related to the amount and availability of soil moisture in the profile. Soil depth and texture are two of the most important characteristics which influence tree growth. Soils which have sandy loam and loam subsoil textures are usually more productive than soils which have finer or coarser textures. Likewise, deeper soils are usually more productive than the shallow soils. Certain soil characteristics also affect the composition of the regenerating vegetation after fires or logging activities. Soils that are very gravelly or cobbly and that are underlaid by well-fractured bedrock, many times are regenerated by dense brush stands. Natural regeneration of conifer species is quite slow in these areas.

The character of the bedrock influences tree growth several ways. The well weathered and/or highly fractured bedrock is a major source of moisture to the tree on many sites. (See Photo 13) This explains why some very shallow soils on the District have moderate to moderately high site indexes. The bedrock also restricts the downward movement of moisture, thus holding it in the subsoil and within reach of the tree roots. The character of the bedrock influences stocking rates on many sites. Areas having highly weathered and/or highly fractured bedrock will support heavier stocking than similar areas which have massive unweathered bedrock.

Landform also influences tree growth. This relationship is generally connected with soil moisture. Areas such as basins and stream terraces receive and hold additional moisture and will have higher timber potentials than convex slopes in areas of moisture loss. The effect of landform on timber growth is amplified by the soils and the bedrock. Basins and terraces generally have finer textured soils and are over more deeply weathered bedrock than convex slopes and are thus more productive. Air drainage is affected by landform. This will affect species, distribution, and growth rates.

Timber Harvesting

The impact of timber harvesting on the lands 9f the District recently has been given much attention. Jensen and Finn 5/conducted an intensive hydrologic analysis of the Zena Creek logging study area in 1966. Megahan has made studies in 1965 6/ and 1967 7/concerning logging impacts in the Zena Creek area. A special study concerning the amounts and sources of sediment in the South Fork of the Salmon River was conducted by Arnold and Lundeen 1/in 1967. The results of all of these studies indicate that sedimentation from logging roads is the single largest impact of the timber harvesting operation. The Cause of the sedimentation is surface erosion of the cut slope, fill slope, and road surface. (See Photo 14.) Other sources of sediment are debris slides above the cut slope and mass failure of the fill slopes. Interpretations of the erosion hazard and the mass stability hazard for each of the land types are given in Table 9, Appendix A.

Removal of vegetation and disturbance of the top soil by the logging operation increases the chances for surface erosion and thereby increases sediment production. The degree of this impact is influenced by the land-form and the logging method used. The type of logging method used is therefore controlled by the slope gradient. Tractor skidding can be used without damage to the watershed on the more gentle slopes. As the slopes become steeper, jammer, high lead, or other systems must be used. Some areas of the District that have very steep slopes and high mass movement hazards will require helicopter or balloon logging.

1/ See footnote 1, page 1.
5/ Jensen, F. R., & L. Finn. 1966 Hydrologic Analysis of the Zena Creek Logging Study Area. U.S.F.S., R-4 Report.
6/ Megahan, W.F. 1965. An evaluation of the Change in Hydrologic Functibn of Watersheds due to Proposed Model Road Construction and Logging and Logging Road Construction on the Zena Creek Logging Study Area. U.S.F.S., R-4 Report (unpublished).
7/ Megahan, W.F. 1967. Analysis of Sedimentation from a Ten Acre Watershed (unpublished data).

Photo 13

This photo shows the influence that the character of the bedrock has on tree growth. It is obvious that the very shallow soil shown in this photo can not supply enough moisture to support the stand of timber shown here.

Photo 14

This photo shows the impact that logging roads have when constructed in moderately fractured, moderately soft, moderately weathered, spelling granitic bedrock. This particular road cut is at least 22 years old and still has not stabilized and is a continuing source of sediment.

ROAD CONSTRUCTION

From past experience we know that road construction on steep mountainous lands with fragile granitic soils is a very difficult and costly job. In terms of impact to the watershed, it has in many cases been very damaging. In some cases this damage can be avoided. However, on many of the lands and slopes where roads have been constructed, it would be almost impossible from a practical cost standpoint to construct logging roads without damaging the watershed. In other less hazardous areas, the damage to the watershed resulting in sedimentation can be reduced substantially with a full understanding of the hazards involved in building roads on these particular kinds of lands. A reconnaissance survey does not predict the particular kind and degree of hazard involved in road construction at any given point or on a station to station basis. However, we are able to predict the general hazards and the degree of hazards which will be encountered in road construction on a certain type of mountain slope or land type. On most of the land types on the District, the land-form, the character of the bedrock, and to a lesser degree, the soils determine the impact that the road will have on a given slope. The impact of any road construction is determined by the degree or extent with which the natural water transmitting properties of the slope have been altered.

Following is a brief discussion of the relationships of soils, character of bedrock, and landform with road construction.

Soils

A characteristic common to most soils on the District is coarse texture and in many cases, poor soil gradation. Many of the soils on the District have a very narrow range of soil particle size distribution, especially soils derived from quartz monzonite. These kinds of soils under the right conditions will have a high mass stability hazard.

Soils which have formed from granitic material generally are quite low in clay content. Few of the soils of the District have clay contents higher than 20 percent. Many of them have clay contents in the 5 to 10 percent range. Because of this, the soil aggregates are very weak, especially when disturbed, and the soils are highly erosive. These soils also cohesive strength and have very low moisture holding capacities which makes stabilization with vegetation on south slopes quite difficult. However, there are also several advantages to soil having very low clay content. These soils are quite stable unless they become saturated. They have high infiltration and percolation rates, good drainage, and have a shrink-swell potential. Because of their good drainage and coarse texture and affected by frost action and also provide a durable wearing surface.

Bedrock Characteristics

The character of the bedrock is an important factor in road construction. Some of the characteristics of the bedrock which are important to engineering practices are the method and degree of weathering, degree of fracturing, minerology, and structure.

Granular exfoliation is a common form of weathering in granitic rocks. This is a mechanical weathering process which is caused by the fluctuation of temperature and moisture. In nature this process gradually rounds and reduces the rock outcrops. When the bedrock is exposed by a road cut, the rock, which appears to be hard and unweathered, is weakened by this process. This is referred to as spalling or air slaking and produces coarse sands and fine gravels which accumulate at the foot of the cut slopes. (See Photo 13.) This causes maintenance problems. This material must be removed from the inside of the drainage ditch to prevent clogging of culverts and subsequent saturation of the road fill. Another type of weathering is chemical weathering. Some bedrock has been weathered to great depths and is weakly consolidated. Colors range from almost white to bright brown. Road cuts are easily made in these materials. Because of the somewhat finer materials, fills produced from this material are relatively stable and vegetation is easier to establish. However, there is a hazard of mass failures on steep cut slopes on this material.

Roads constructed through bedrock that is highly fractured will generally cause less impact on the land than roads built through massive bedrock. The fractured bedrock provides strength to fills and sub bases. However, there is the hazard of intercepting subsurface flow in bedrock of this type.

Bedrock structure is also an important consideration in road construction. Slopes with the dominant jointing plane into the slope are more stable than slopes with the dominant jointing plane parallel to the slope. The dominant jointing plane on the District dips toward the south. The north-facing slopes tend to be more stable than the south-facing slopes. The south-facing slopes are more deeply incised and water is removed from these slopes as surface flow, resulting in a high surface erosion hazard. The north-facing slopes are less deeply incised. They have greater accumulations of loose materials and subsequently greater amounts of subsurface flow which tends to increase the hazards of mass stability.

Landform

Road construction and other engineering practices are much more hazardous on some land types than on others. Land types in the Fluvial Lands such as Moderately and Strongly Dissected Mountain Slope Land are more hazardous to road construction than the Weakly Glaciated Lands which have drainage pattern. The slope forming processes on the Weakly Glaciated lands produce slopes which have well graded soils,

unconsolidated subsurfaces, and well weathered bedrock. Most of the moisture that falls on these slopes is percolated deeply into the soil mantle and bedrock and flows off as subsurface flow. The slope forming processes that are active in the Fluvial Lands concentrate moving surface water into draws which endanger road fills which may cross these draws. Soil materials on these lands are more uniform and have poor gradation, resulting in less stable fill slopes.

Land types such as Oversteepened Oanyon Lands which have been subjected to faulting and subsequent uplift, have over-steepened slopes which tend to be unstable. Debris slide hazards and surface erosion hazards are quite high on these lands. Many of the steep north-facing slopes adjacent to the South Fork of the Salmon River are being subjected to undercutting by the river, which also results in an oversteepened slope. Slope gradients in excess of the angle of repose of the soil materials are made possible on these slopes by the dense vegetative cover. The possibility of cutbank failures on roads built on these kinds of slopes is very high.

The mass stability and surface erosion hazard in connection with road construction is given for each land type in Table 9, Appendix A.

RECREATION

Campgrounds

There are several strong relationships between soils and landform to the suitability of any given site for a campground. Because of the reconnaissance nature of this survey, no interpretations for campground suitability have been made. The soils on the District are generally satisfactory for campground development. These soils, as mentioned previously, have high infiltration rates and are all well drained. Compaction hazard is low.

Some of the land types are more suitable for camp sites and campgrounds than others. This is due mainly to the topographic limitations of the land types. The campgrounds will generally have to be located on low relief uplands such as the Weakly Glaciated Lands and land types such as Terrace Land, Alluvial Lands, and Glacial Outwash Land. These are generally the land types which have slope gradients and relief which is consistently low enough to develop a camp site on.

Hiking and Horseback Riding

Some of the land types offer better opportunities for hiking and horseback riding than do others. Many of the land types in the Weakly Glaciated Lands and Strongly Glaciated Lands are easily traversed by foot or horseback and provide many viewpoints and scenes which are

aesthetically pleasing. Subalpine Rim Land, for instance, is easily traversed by either foot or horseback and provides many aesthetically pleasing overlooks. Land types such as the Cirque Basin Land offer excellent camp sites and also provide good fishing in the Cirque Lakes.

RANGE AND WILDLIFE

Evaluations for range and wildlife have not been made at this time.

LAND TYPE DESCRIPTIONS

The land type is the basic unit of this report. This is the unit of land that has been described and interpreted. Land types are areas of land that have similar geomorphic origin, geology, topography, soils, drainage patterns, and other external landscape features. Land types have strong life zone connotations. They have soil and vegetation associations that are unique to a particular land type. This section includes a description of each land type containing the following information:

1. Name of unit and map symbol.
2. A colored photo of the land type. A photo is lacking for some of the land types.
3. Typical location.
4. Management zone in which the land type is usually found.
5. Extent - acres and percent of area.
6. Topography - dominant slope range, aspect, and elevational range of land type.
7. Geomorphic features of the land type.
8. Character of the bedrock.
9. Dominant vegetation.
10. Brief description of soils and percent of each.
11. A statement concerning the management qualities and characteristics of the unit.
12. Management Evaluation - space for comments and observations about performance of land type.

In writing the land type descriptions, the normal or typical characteristics of a particular land type were described. In a reconnaissance survey there will be examples of land types that have somewhat different soils, vegetation, or bedrock characteristics from those described. However, when these areas are combined into broad groupings, as in this survey, these variations become compensating and the descriptions are realistic for the level at which this report is to be used.

Alphabetical Index to Land Type Descriptions

STRONGLY GLACIATED LANDS

Listed below are the land types that have been mapped in this geomorphic group. Depositional Land Types such as Valley Train Land, Alluvial Land and Moraine Land have been mapped in the Strongly Glaciated Lands but are described with the rest of the depositional units.

Name	Map Symbol	Acres	%of Area
Toe Slope Land	107	1,136	.5
Glacial Plastered Mountain Slope Land	108	12,978	5.3
Cirque Basin Land	110	3,949	1.6
Scoured Cirque Basin Land	110X	4,290	1.8
Weakly Dissected Glacial Trough Land	111a	9,835	4.0
Moderately Dissected Glacial Trough Land	111b	11,696	4.8
Strongly Dissected Glacial Trough Land	111c	6,486	2.6
Steep Rocky Cirque Headland	111d	2,842	1.2
Rocky Ridge Land	113	9,934	4.0
Subalpine Rim Land	114	5,648	2.3
Glacial Scoured Mountain Slope Land	115	518	.2
Total		69,312	28.4

Strongly Glaciated Lands occupy the headlands of most of the drainage tributaries of the South Fork of the Salmon River. The landscape is typical of alpine glacial topography.

Alpine glaciers originated at the heads of "V" shaped stream cut canyons. They started as snowfields under a climatic regime with much freezing and thawing. These processes quarried rock at the heads and sides. As the glacier gained in mass, it started moving downstream and started an "ice-plucking" process which was largely responsible for the amphitheater-shaped cirques. As more and more ice mass was accumulated, more downstream scouring, polishing and truncation work was accom-plished. These processes changed the original "V" shape to "U" shape with its truncated spur ridges, over-steepened slopes, hanging valleys, and its depositional valley train of ice deposited morainal materials, water-worked outwash, and stream-laid materials. Because much of the weathered rock material has been stripped away by ice action, the bedrock on these glaciated lands is

generally harder and more fractured than the bedrock of non-glaciated and Weakly Glaciated (periglaciated) Lands.

The Strongly Glaciated Lands are the chief water producers in the area. These lands provide 40 to 60 percent of the 35 to 60 inches of the precipitation they receive as stream flows. The Cirque Basins have a large storage capacity in their lakes and meadows and help sustain yearlong flows to the streams below. The Valley Train Lands help retard the flow from the steep glacial troughs above and return moisture to the streams as subsurface and ground water flows.

Snow accumulation on these lands is the highest in the area. The ratio of surface runoff to subsurface and ground water on some Glacial Trough Lands is high and would be extremely high but for the generally fractured nature of the bedrock.

The Strongly Glaciated Land geomorphic type is relatively stable. Soils are generally stony, coarse textured, light colored and provide materials with a favorable graduation of size classes for relatively stable road fill construction. Road cuts generally do not expose bedrock which spall upon exposure to the atmosphere and because soil mantles are generally quite thin in non toe slope positions, the back slope stability is relatively high. However, because of the hard, unweathered nature of the bedrock, road cuts will be difficult and costly.

These lands provide some of the highest "back country" dispersed recreational values found outside Wilderness Areas in this part of the state. Fishing in some of the lakes is excellent, early season elk hunting is good, and these lands are "big" and aesthetically pleasing to many people.

The hazard for avalanches is higher on these lands than any other in the area and there are numerous draws subject to high runoff from high intensity storms. Some of these draws have well-developed fans indicating that they periodically provide mud rock flows and debris slides from high intensity storms.

The Strongly Glaciated Land geomorphic type is the least productive for growing timber. Land types like Cirque Basins, Rocky Ridge Land, Subalpine Rim Land, and the more heavily scoured and higher elevational Glacial Trough Lands do not support commercial timber. Subalpine fir and lodgepole pine with minor amounts of Engelmann spruce are the most common species on these land types. Other species such as Douglas-fir and white bark pine are less common. Some of the lower elevational Glacial Trough Lands, particularly on north slopes, support dense mixed stands of Douglas-fir, larch, and some white fir and ponderosa pine. Site indexes for these kind of lands for Douglas-fir are variable and range from 50 to 80 feet at a hundred years. Some of the highest productive lands for spruce are in pockets in the Valley Train Lands

(Moraine, Toe Slope, and Alluvial Lands). These stands at the toes of steep south-facing slopes which have been heavily grazed intercept most of the sediment off the eroding slopes.

Herbage productivity is generally low for the Strongly Glaciated Lands. However, the meadows in the Cirque Basins and Valley Train Lands may produce as high as 3,000 pounds per acre per year. Some south-facing glacial stands of timber and mixed brush types may be capable of producing 500 to 800 pounds per acre per year. But the acreage of these more productive areas is small. These lands do, however, provide the summer deer and elk range, and cover and food for a small upland game bird population.

Photo 15

This is a typical scene in the Strongly Glaciated Lands. The barren ridges in the background have been mapped as Rocky Ridge Land (113). The slope in the foreground and the slopes below the Rocky Ridge Land have been mapped as Moderately and Strongly Dissected Glacial Trough Land(lllb, 111c).

Photo 16

North Fork of the Gold Fork River. This photo shows the relative position in the landscape of some of the glaciated land types.

Photo 17

A view of a talus slope. These slopes are common in Rocky Ridge Land (113 and to a lesser extent on Strongly Dissected Mountain Slope Land (111c). These slopes greatly reduce surface runoff and contribute to sustained stream flow.

Photo 18

This is a snow avalanche path typical of the slopes along the sides and heads of Strongly Glaciated Lands. The avalanche hazard is especially high on land types such as Rocky Ridge Land (113), Strongly and Moderately Dissected Mountain Slope Land (111c, 111b), and Steep Rocky Cirque Head Land (111d).

TOE SLOPE LAND
Map Symbol 107

Location - Bull Creek, East Fork of Clear Creek

Management Zone - Mostly Intermediate

Extent - Acres: 1,136
Percent of Area: .5

Topography - Slope Gradient: 35-55%
Aspect: All
Elevation: 4000' - 7000'

Geomorphic Features - This land type is located at the toes of glacial roughs and dissected mountain slopes. Toe Slope Land consists of relatively deep accumulations of gravity borne materials from adjacent higher slopes. These accumulations are generally stony at the foot of steep glacial troughs but are generally less stony at the foot of the dissected mountain slopes. Toe Slope Land occurs in units large enough to delineate consistently mainly at the toes of glacial troughs. Toe Slope Land is a significant inclusion in Dissected Glacial Trough Land and. Dissected Mountain Slope Land.

Bedrock Characteristics - The granitic bedrock of this unit is slightly fractured and moderately hard, somewhat weathered to moderately soft, moderately weathered.

Vegetation - The dominant vegetation on this land type in the Fluvial Lands at lower elevations is ponderosa pine over a pine grass ground cover. Vegetation at the higher elevations consists of lodgepole pine, sub-alpine fir, Douglas-fir over an elk sedge or low huckleberry ground cover. The ground cover density in this unit ranges from 30 to 8o percent. The crown cover of the overstory ranges from 20 to 30 percent and 10 to 20 percent for the understory.

Soils - The dominant soils on this land type and the composition are 9b (40%), 1 (40%) and 5 (20%). The 9b and 5 soils are generally found at the higher elevation. The 9b soil has stony sandy loam surfaces and subsurfaces. The 5 soil has light colored sandy loam surfaces over sandy loam subsurfaces. The 1 soil is generally found in the lower elevations and has loamy sand or sandy loam surface over loamy sand subsurfaces. All of the soils on this land type are usually at least 60 inches or more to bedrock.

Management - Qualities Hydrologically these slopes take in and percolate water readily. These lands, because of their position, are subject to saturation from above. In road construction, cut bank slope stability is apt to be low, especially in wet or potentially wet areas. Cut in these slopes should be avoided unless thoroughly evaluated for stability. The deep, stony accumulations, however, do act as a buffer absorbing surface runoff and returning it to adjacent streams as subsurface flow. Some of these lands are among the most productive in the survey area for timber production. Sight indexes of 90 to 110 are not uncommon.

Management-Evaluation

GLACIAL PLASTERED MOUNTAIN SLOPE LAND
Map Symbol 108

Location - Rice Creek, Lodgepole Creek, Bear Creek

Management Zone - Crest and Intermediate

Extent - Acres: 12,978
Percent of Area: 5.3

Topography - Slope Gradient: 35-45%
Aspect: Dominantly North and East
Elevation: 5,500' - 7500'

Geomorphic Features - These land types are the glacially modified slopes which have had glacial material deposited on them rather than stripped away by the scouring of the glacier. These lands are generally benchy and have fairly thick. soil mantles on them. Some of these lands are in the glacial troughs. These lands contain considerable lateral moraine materials with typically sub-rounded glacial worked rock fragments.

Bedrock-Characteristics - The granitic bedrock is generally moderately fractured and ranges from somewhat weathered to soft, well weathered.

Vegetation - Vegetation on southerly and westerly slopes consists of moderately dense stands of Douglas-fir, lodgepole pine, and some ponderosa pine, with understories of

pine grass and elk sedge. Northerly slopes have lodgepole pine and Douglas-fir with an elk sedge, pine grass and tall huckleberry ground cover. The ground cover density ranges from 60 to 90 percent. The crown cover density for the overstory ranges from 25 to 35 percent and 20 to 30 percent for the understory.

Soils - The dominant soils on this land type are 9b (40%) lla (25%) and 15 (25%). The 9b and 15 soils have sandy loam surfaces and subsurfaces and are generally stony throughout. The lla soil has stony surfaces and subsurfaces and has loamy sandy textures throughout the profile. The 9b and 15 soils are generally on the northerly aspects and produce moderately dense stands of Douglas-fir and lodgepole pine. The lla soil is generally on the more southerly aspects and produces moderate stands of Douglas-fir and ponderosa pine. Soil erodibility for these soils ranges from low to moderate.

Soils on this unit generally average from 4 to 6 feet to bedrock.

Management - Qualities These lands, because of the favorable gradation of soil materials and benchy slopes under 55 percent present favorable road location chances. Wet spots are fairly common and they should be recognized as increasing the chances for mass failures of the cutslope. Road fills on these lands are fairly stable. On steep slopes the fill slope erosion hazard is moderate to moderately high. The inherent erosion hazard is moderately low to moderate. Timber productivity is medium and herbaceous vegetation productivity is moderately low under conifer vegetation.

Management-Evaluation

CIRQUE BASIN LAND Map
Symbol 110

Location - The head of Warm Lake Creek, Roaring Creek

Management Zone - Crest

Extent - Acres: 3,949
Percent of Area: 1.6

Topography - Slope Gradient: 10 - 30%
Aspect: Dominantly North
Elevation: 7,000' - 8,500'

Geomorphic Features - This land type consists of amphitheater-like basins that are found at the heads of most of the glaciated valleys on the District. Some of the cirque basins have small lakes in them. Common inclusions in this land type are narrow strips of Valley Train Land and Toe Slope Land. In the larger cirques there usually are small areas of wet Alluvial Lands near the lakes.

Bedrock Characteristics - The granitic bedrock is generally hard, unweathered, nonspalling and slightly to moderately fractured.

Vegetation - Dominantly lodgepole pine, subalpine fir and some Engelmann spruce in the low areas. Ground cover is mostly low huckleberry and elk sedge. Ground cover density including litter ranges from 30 to 60 percent.

Soils - Dominant soils on this land type are lla (30%), 9b (30%), 8b (20%), 9c (20%). Soils are generally stony with subangular coarse fragments from 4 inches to one foot in diameter. These soils have loamy sand and sandy loam surfaces over bright colored loamy sands and sandy loam subsurfaces. Depth to bedrock averages 20-40 inches. The 9b and 9c soils are found on the lower north slopes and in the depressional areas and may support a good stand of Engelmann spruce over low huckleberry and elk sedge. The other soils support open to dense stands of lodgepole pine and subalpine fir with elk sedge and low huckleberry the dominant Bound cover.

Management - Qualities These lands are one of the chief regulators for sustained stream flow. The depressional nature of the landscape allows for deep percolation and the return of water as subsurface flow and ground water. Because of the short growing season, productivity for timber is generally low except for small stands of spruce which may be medium. Potential for forage production is also low. The engineering characteristics of these lands are favorable in most respects, except for some of the Wet Alluvail Lands and wet meadows. These lands contain many lakes which have been stocked and provide excellent fishing. These areas also provide some favorable big game summer range. These lands, because they are easily traversed by foot or horseback, are an important part of the high value dispersed recreational area associated with the rest of the land type in the Strongly Glaciated Lands.

Management – Evaluation

SCOURED CIRQUE BASIN LAND
Man Symbol 110X

Location - Head of Bull Creek and Roaring Lake Area

Management Zone - Crest

Extent - Acres: 4,290
Percent of Area: 1.8

Topography - Slope Gradient: 20-35%
Aspect: Dominantly North
Elevation: 7000' - 8500'

Geomorphic Features - This land consists of shallow glacial scoured amphi-theater-like basins that are found at the heads of many of the glaciated valleys on the District. The land is similar to Cirque Basin Land (map symbol 110) except that it is steeper and as a result of the scouring has a thinner soil mantle.

Bedrock Characteristics - The granitic bedrock is generally hard, unweathered, non-spalling and slightly to moderately fractured.

Vegetation - Dominantly sparse stands of lodgepole pine, white-bark pine and subalpine fir over a sparse under-story of low huckleberry and elk sedge. Ground cover density ranges from 20 to 40 percent. The crown cover for the overstory ranges from 5 - 15 percent and for the understory 0 - 10 percent.

Soils - The soils of this land type are typically stony or extremely stony and depth to bedrock is dominantly less than 20 inches. The rock outcrop in this unit will range from 5 to 40 percent and averages 20 percent. The dominant soils on this land type are 10a (60%) and lla (20%). There are minor inclusions of 9a and 9b soils on this unit also. These soils have stony loamy coarse sand surfaces over stony loamy coarse sand sub-surfaces. The 10a soil and the rock outcrop occur on the steeper slopes and the lla soil on the more gentle slopes.

Management - Qualities These lands are less effective as regulators for sustained flow than are the Cirque Basin Lands (Map Symbol 110). The management qualities for this unit are quite similar to Cirque Basin Land. Productivity for all vegetation is dominantly lower than is Unit 110. The inherent erosion hazard for this unit is moderate. The avalanche hazard is moderately high, primarily because it is generally located below land types that have high avalanche hazards.

Management-Evaluation

WEAKLY DISSECTED GLACIAL TROUGH LAND
Map Symbol 111a

Location - Bear Creek and Rice Creek, Alpine Creek

Management Zone - Crest, Some Intermediate

Extent - Acres: 9,835
Percent of Area: 4.0

Topography - Slope Gradient: 40 - 55%
Aspect: Dominantly North and East
Elevation: 5500' - 8000'

Geomorphic Feature: These lands occupy the side slopes of the U-shaped troughs that are typical of alpine glaciated mountains. Slopes have been over-steepened and the V-shaped alluvial canyon: have been altered to the U-shape by the ice action of the glaciers. The drainage patterns on these lands are typically parallel as compared to the dendritic pattern found in the Fluvial Lands. This land type is smooth and weakly dissected by parallel drainages spaced greater than 1500 feet apart and entrenched at depths ranging from 10 to 30 feet. Drainages spaced closer than 1500 feet are less than 10 feet deep, and drainages greater than 3000 feet may be deeper than 30 feet. The

mantle is 3 to 4 feet deep and contains large volumes of angular coarse fragments, three to 8 inches in diameter.

Bedrock Characteristics - The granitic bedrock is moderately to well fractured and is generally hard to moderately hard and non-spelling.

Vegetation - Dominantly lodgepole pine, subalpine fir, Douglas-fir, with some whitebark pine. Ground cover generally consists of low huckleberry and elk sedge. The ground cover density ranges from 30 to 70 percent. Crown cover for the overstory is from 10 to 25 percent and for the understory from 5 to 20 percent.

Soils - The dominant soils on this unit are lla (40%) 8a (35%), 9 (25%). There are also minor inclusions of 9b and 10a. The soils are generally stony in the subsurface and on the surface. They have sandy loam and loamy sand surfaces over loamy sand subsurfaces. Depth to bedrock averages from 20 to 40 inches. The 9 and the 8a soils occur on the more northerly exposures and the lla soils are found on the exposures which have a southerly aspect.

Management - Qualities Productivity for timber is moderately low. The inherent erosion hazard is moderate, the surface erosion hazard for cut and fill slopes is moderate. There is a moderate mass stability hazard of cut slopes in this land type. The avalanche hazard ranges from moderately low to moderate. Because of the fractured nature of the bedrock there would be fairly deep moisture percolation and much of the water would be returned as subsurface flow. The engineering characteristics of this land type are favorable in most respects.

Management - Evaluation

MODERATELY DISSECTED GLACIAL TROUGH LAND
Man Symbol 111b

Location - Lodgepole, Knox and Rice Creeks

Management Zone - Crest and Some Intermediate

Extent - Acres: 11,696
Percent of Area: 4.8

Topography - Slope Gradient: 45 - 60%
Aspect: All
Elevation: 5500' - 8000'

Geomorphic Features - Similar to Weakly Dissected Glacial Trough Land (111a) except that these lands are more strongly dissected and are incised by generally parallel drainages between 500 and 1000 feet apart and entrenched in the slope at depths ranging dominantly from 10 to 30 feet. Drainages spaced at distances greater than 1500 feet may be deeper than 30 feet. Drainages spaced closer than 500 feet may be less than 20 feet deep.

Bedrock Characteristics - The granitic bedrock is moderately to well fractured and is hard to moderately hard and non-spalling. Dominant jointing planes are roughly parallel to the slope on south aspects.

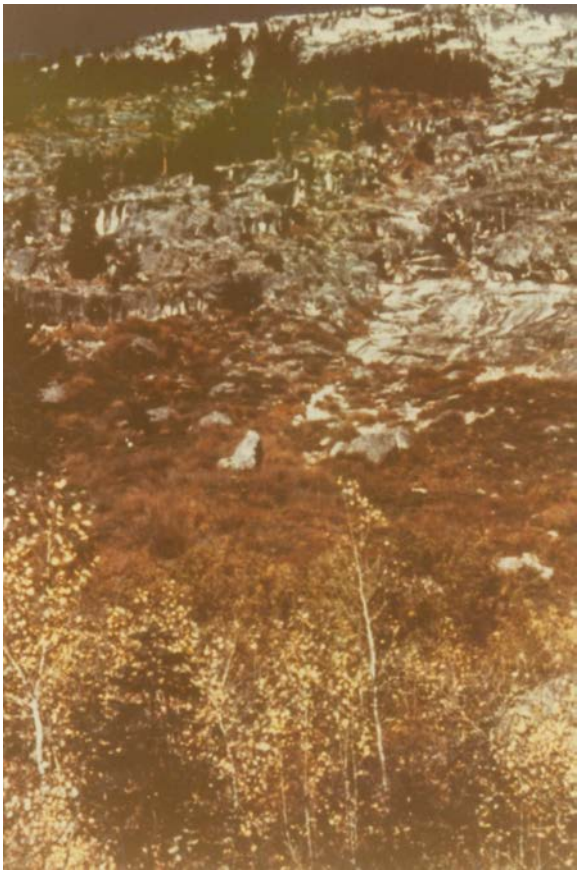
Vegetation - Mostly lodgepole pine, subalpine fir and Douglas-fir with some whitebark pine. Ground cover generally consists of low huckleberry and elk sedge. Ground cover density ranges from 30 to 60 percent and the crown cover for the overstory ranges from 10 to 15 percent and 5 to 15 percent for the understory.

Soils - The dominant soils on this land type are lla (30%), 9 (30%), 10a (20%) and 9b (20%). The soils are dominantly 20 to 40 inches to bedrock with 20 to 25 percent of the soils being less than 20 inches in depth. lla and 10a soils occur on southerly aspects and 9 and 9b soils occur on the more northerly aspects. Most of the soils are stony on the surface and in the subsurface. These soils have sandy loam and loamy sand surface textures over sandy loam and loamy sand subsurface textures.

Management Qualities - This land type has a moderately low to moderate productivity potential for timber and forage. Engineering problems on this land type are mainly related to the steep slopes. Because of the high strength properties of the bedrock on these lands back slopes stand at a relatively steep angle. Much of the rock is relatively fresh and non-spalling. The inherent erosion hazard on this land type is moderate and the surface erosion hazard for the fill slopes is also moderate. The avalanche hazard on the unit is moderate to moderately high. The mass stability hazards are generally moderately low on this unit.

Management Evaluation -

STRONGLY DISSECTED GLACIAL TROUGH LAND
Map Symbol 111c



Location - Bull Creek
Cabin Creek

Management Zone - Crest

Extent - Acres: 6,486
Percent of Area: 2.6

Topography - Slope Gradient: 60 -75%
Aspect: All
Elevation: 6000' - 8200'

Geomorphic Features - Similar to land types 111a and 111b except that these lands are much more strongly dissected and are incised by dominantly parallel drainageways which are less than 500 feet apart: and are 20 feet deep or less. Some of the lands are more deeply entrenched by drainages up to 1,500 feet apart. Included in some of these lands are narrow bands of The Slope Land and small alluvial fans. This unit differs from the other Glacial Trough Lands in that it typically has from 15 to 25 percent rock outcrop. Talus slopes are quite common on this land type. The mantle is much thinner on this land type than on the other Glacial Trough Lands.

Bedrock Characteristics - Granitic bedrock is generally hard, unweathered, non-spalling and moderately fractured.

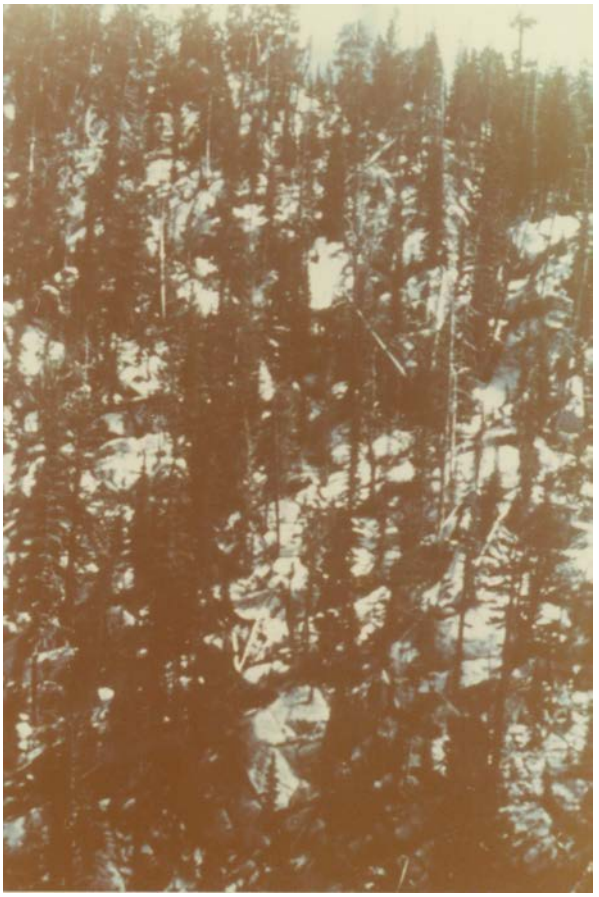
Vegetation - The dominant tree species on these land types are scattered, sparse stands of Douglas-fir, subalpine fir, lodgepole pine and whitebark pine. The ground cover is mostly high mountain brush having densities ranging from 20 to 60 percent. The crown cover is 0 to 10 percent for the overstory and 20 to 40 percent for the understory.

Soils - The dominant soils in this land type are 10a (50%), 10 (30%), lla (15%). There is also 15 percent rock outcrop. The soils on this unit are generally less than 20 inches to bedrock, are stony to extremely stony and have loamy sand surface textures over loamy sand subsurface textures.

Management Qualities - These lands have the highest avalanche hazard of any land type on the District. Surface runoff potentials are high and structures built across drainages are subject to damage from high intensity summer storms. The inherent erosion hazard is moderately high. The steepness and degree of dissection of the middle and upper portions of the slope makes road construction across faces of the slopes difficult and very costly. Generally, the best road locations on these slopes are on the lower portions. Productivity potentials of these lands are low to moderately low for timber and moderately low for herbaceous vegetation.

Management Evaluation -

STEEP ROCKY CIRQUE HEADLAND
Map Symbol 111d



Location - Head of Cabin Creek

Management Zone - Crest

Extent - Acres: 2,842
Percent of Area: .2

Topography - Slope Gradient: 60 - 75%
Aspect: Dominantly North
Elevation: 7000' - 8500'

Geomorphic Feature - These lands are the steep rocky ice plucked cirque headlands of minor drainages and are located above the cirque basin. There are inclusions of Rocky Ridge Land (113) mapped with this land type.

Bedrock Characteristics - Granitic bedrock is hard, unweathered, nonspalling and moderately fractured.

Vegetation - The timber species are lodgepole pine and whitebark pine. The ground cover is brush and elk sedge. The ground cover density ranges from 15 to 40 percent. The crown cover for the overstory ranges from 0 to 5 percent and 5 to 15 percent for the understory.

Soils - The dominant soils on this unit are 10 (50%), 10a (30%) and 20 percent rock outcrop. These soils are less than 20 inches to bedrock and are stony. The surface and subsurface have loamy sand textures throughout.

Management - Qualities Similar to Strongly Dissected Glacial Trough Land (map Symbol 111c). The avalanche hazard is high on this land type. Surface runoff is high and structures built across drainages are subject to damage from high intensity summer storms. The inherent erosion hazard is moderately high. Productivity potentials for timber and herbaceous vegetation is low.

Management - Evaluation

ROCKY RIDGE LAND
Map Symbol 113

Location - Rocky Peak and Monumental Peak Areas

Management Zone - Crest

Extent - Acres: 9,934
Percent of Area: 4.0

Topography - Slope Gradient: 65 - 80%
Aspect: All
Elevation: 7000' - 8700'

Geomorphic Features - This land type consists of the highest ridges, upper slopes and extremely rocky spur ridges. This land type occurs mainly at the higher elevation glaciated lands in the survey area. Included in this land type are Cirque Head Walls, Rocky Cirque Headlands and small areas of Moderately to Strongly Dissected Glacial Trough Land. Talus slopes are common and the percentage of rock outcrop is commonly over 50 percent. Slopes are quite variable and are often 90 percent or more.

Bedrock Characteristics - The granitic bedrock is hard, unweathered, nonspalling and moderately fractured.

Vegetation - Sparse stands of lodgepole pine, subalpine fir with some whitebark pine. Sparse understory of elk sedge, low huckleberry and some brush. Ground cover density ranges from 5 to 20 percent. Crown cover is 0 to 5

percent for the overstory and 5 to 10 percent for the understory.

Soils - The dominant soils in this unit are 10a (35%), lla (15%) and rock outcrop 50 percent. These soils are dominantly less than 20 inches to bedrock. The 10a soil on this unit is very shallow, often less than 10 inches to bedrock. It is stony on the surface and in the profile and has loamy coarse sand textures throughout. The lla soil is stony and has loamy sand textures throughout. The 108 soil is on the steep upper slopes adjacent to the rock outcrop. The lla soil is on the lower more gentle slopes.

Management - Qualities These lands are geologically young and the erosion is very active. They offer only low productivity potentials for vegetation. The inherent erosion hazard is high in places and the avalanche hazard is high. Depending upon the degree of fracturing in the bedrock and the number of talus slopes the water yield for this unit would range from moderate to high.

Management - Evaluation

SUBALPINE RIM LAND
Map Symbol 114

Location - Rice Creek and Area North of Stony Meadows

Management Zone - Crest

Extent - Acres: 5,648
Percent of Area: 2.3

Topography - Slope Gradient: 40 - 55%
Aspect: Dominantly South and West
Elevation: 7000 - 8000'

Geomorphic - Features: This land type consists of subalpine mountain shoulders which were somehow protected from severe glaciation scouring and have not been dissected by geologic stream actions since glaciation. The slopes are relatively smooth, straight to weakly convex extending from the ridgetop to as much as 1,000 feet in elevation downslope. This land type is mostly on the south and west facing slopes; the adjacent land-form on the north and east facing slopes is commonly Steep Rocky Cirque Headlands.

Bedrock-Characteristics: The granitic bedrock is hard to moderately hard non-spalling and moderately to extremely well fractured.

Vegetation - This land type has several vegetative types. One consists of park-like stands of subalpine fir and open areas of grasses and sedges. Open grassland is also common. Some areas also have fairly dense stands of lodgepole pine over elk sedge. The ground cover density ranges from 15 to 50 percent. The crown cover for the overstory ranges from 0 to 15 percent, the understory 0 to 5 percent.

Soils - The dominant soils in this unit are 8b (40%), 8a (30%) and lla (30%). Commonly these soils are extremely stony, average 20 to 40 inches to bedrock, have loamy sand and sandy loam surface textures over loamy sand subsurface textures. There are inclusions of 9 and 10a soils on this land type.

Management - Qualities These lands, because of their exposed position and high elevation are subject to severe climatic conditions such as freezing and thawing, wetting and drying, and high winds. For this reason the productivity potentials for timber are low and moderately low for herbaceous vegetation. The inherent erosion hazard of this land type ranges froth moderately low to moderate. The avalanche hazard in this unit ranges from moderate to moderately high. These lands do provide some important summer range for elk and deer. These lands, because of the extremely stony nature of the soils and the fractured bedrock have favorable engineering characteristics.

Management - Evaluation

GLACIAL SCOURED MOUNTAIN
SLOPE LAND
Map Symbol 115

Location - North Fork of the Gold Fork River

Management Zone - Crest

Extent - Acres: 518
Percent of Area: .2

Topography - Slope Gradient: 45 - 60%
Elevation: 7000' - 9000'

Geomorphic Features - This land type consists of steep benchy mountain shoulders which have been scoured by alpine glaciers. They generally occur down stream from the Cirque Basin Lands and are between Subalpine Rim Land and the Glacial Trough Land. They are most similar to Smooth to Weakly Dissected Glacial Trough Land except that they are benchy, have up to 30 percent rock outcrop and as a result of the scouring have a thinner mantle.

Bedrock Characteristics - The granitic bedrock is mostly hard, to moderately hard, non-spalling and slightly to moderately fractured.

Vegetation - Dominantly sparse stands of lodgepole pine over low huckleberry and elk sedge. Ground cover density for the unit ranges from 15 to 40 percent. The crown cover densities for the overstory are 5 to 15 percent and 5 to 10 percent for the understory.

Soils - The dominant soils on this land type are 10a (70%), lla (20%) and rock outcrop 10 percent. These soils are typically less than 20 inches to bedrock, have stony surfaces and subsurfaces and have loamy sand textures throughout.

Management - Qualities These lands have a low to moderately low productivity for timber and herbaceous vegetation. The engineering characteristics of these lands are generally favorable. in most respects. The inherent erosion hazard is moderately high but because of the stable bedrock and very stony soils the surface erosion hazard for road construction and mass stability hazrds are low and moderately low. The avalanche hazard on this unit would be moderately high.

Management - Evaluation

WEAKLY GLACIATED UPLANDS

Listed below are the land types that have been mapped in this geomorphic group:

Name	Map Symbol	Acres	% of Area
Weakly Glaciated Upland	109	18,478	7.6
Thin Mantled Weakly Glaciated Upland	109a	8,969	3.7
Moderately Dissected Weakly Glaciated Upland	109b	9,555	3.9
Total		37,002	15.0

Weakly Glaciated (periglaciated) Lands are near areas of land which have been strongly glaciated and are the result of the climatic change brought about by the glaciers. In the weakly glaciated land forming processes the effects of ice or permanent snow field action was mainly localized. Soil and rock materials were not carried by major ice currents, nor was the bedrock deeply stripped. The bedrock on the weakly glaciated land types is, therefore, more weathered and less fractured than in the Strongly Glaciated Lands. Except for the 109b unit the Weakly Glaciated Lands have weakly expressed drainage patterns. This is due partially to the localized grinding action of snow and ice fields and partially to the dominant kinds of slope forming processes presently active on these slopes. The Weakly Glaciated Landscapes are at elevations where nivation, freezing and thawing, wetting and drying, make mass wasting the chief process by which materials are moved downslope. These processes keep replacing materials which may have been removed by overland flow.

Soils are mostly stony on the surface and in the profile but some areas are non-stony. Soil textures range from loamy sand to loamy in the surface and loamy sands to sandy loamy in the subsurface. Surface layers commonly have sand fractions which are high in the fine and medium sizes and high silt contents.

These lands take in and percolate water readily and have some of the most favorable hydrologic characteristics found in the area. Precipitation on these lands ranges from 35 to 45 inches annually; 70 to 90 percent of which falls as snow. Most of the water is returned to the stream by subsurface flow.

Engineering characteristics are generally favorable on these lands. One exception to this is when deep cuts are made in these lands. This increases the chances of uncovering seeps which cause weak back slopes and require draining to fill strength. Also, deeply weathered bedrock is common on these lands and cuts in these areas provide poorly graded material for fill construction and deep back slopes are subject to surface erosion.

Photo 19

This is a close-up of a weakly glaciated (Periglaciated) slope. Notice the rounded shape of the rock. This is caused by the localized grinding action of snow and ice fields. These lands have not been scoured by major ice currents. The slope is 45%.

WEAKLY GLACIATED UPLAND
Map Symbol 109

Location - Cupp Corral and East Mountain Lookout Areas

Management Zone - Mostly Crest, Some Intermediate

Extent - Acres: 18,478
Percent of Area: 7.6

Topography - Slope Gradient: 25 - 40%
Aspect: All
Elevation: 5500' - 7500'

Geomorphic Features - Weakly Glaciated Uplands have not been subjected to the scouring action of the Strongly Glaciated Lands. These lands are near areas of land which have been strongly glaciated and are the result of the climatic change brought about by the glaciers. These lands have been formed by the processes and effects of permanent snow and ice field action and any movement of materials was only locally. Soil and rock materials were not carried by major ice currents nor was the bedrock deeply stripped. These lands generally have not been dissected to any great degree by fluvial processes. This is due partially to the localized transportation of materials in snow and ice fields and partially to the dominant kinds of slope forming

processes presently active on these slopes. The Weakly Glaciated (periglaciated) Landscapes are mainly at elevations where nivation, freezing and thawing, wetting and drying make mass wasting the chief process by which materials are moved down slope. This process keeps replacing materials which may have been removed by overland flow.

Bedrock-Characteristics — The granitic bedrock is slightly to moderately fractured and moderately soft, moderately weathered.

Vegetation - This land type supports mixed stands of subalpine fir, lodgepole pine and Engelmann spruce with under-stories of low and tall huckleberry, elk sedge, and pine grass. The ground cover density ranges from 50 to 80 percent. The crown cover for the overstory ranges from 5 to 30 percent and from 0 to 20 percent for the understory.

Soils - The dominant soils on this unit are 9b (40%), 8b (20%), and 9d (20%). The 9b and 8b soils are generally stony throughout and have sandy loam surfaces over loamy sand subsurfaces. The 9d soil is non-stony on the surface and throughout the profile and has fine sandy loam textures over sandy loam and loamy sand subsurface textures. This soil is less than 20 inches deep to highly weathered bedrock. Depth to bedrock for the other soils averages 3 to 5 feet with some areas being up to 10 feet. The 9b soil generally support timber stands and the 8b soils generally have sparser stands of timber and more grass vegetation on them.

Management Qualities - Engineering-wise these lands should provide few problems except for moderate to moderately high surface erosion hazards on cut and fill slopes and a moderate to moderately high mass failure hazard for the cut slope in areas of seeps and wet spots. The structures such as trenches or below standard roads on these lands provide less impact than most other lands of comparable slope gradient in the Fluvial Lands. The main reasons for this are generally the stony nature of the soil mantle and the deeper subsurface flow line. Shallow cuts, therefore, are less apt to intercept the subsurface flow line. The inherent erosion hazard for this unit is moderately low to moderate. Productivity for timber and herbaceous vegetation on this land type will range from moderately low to moderate. These lands are good regulators of sustained stream flow as they take in and percolate water readily.

Management - Evaluation

THIN MANTLED WEAKLY GLACIATED UPLAND
Map Symbol 109a

Location - Area North of Dollar Creek

Management Zone - Crest

Extent - Acres: 8,969
Percent Slope: 3.7

Topography - Slope Gradient: 25 - 40%
Aspect: All
Elevation: 5500' - 7500'

Geomorphic Features - The Thin Mantled. Weakly Glaciated Land was formed in areas where the ice accumulations, except for scattered spalling stones and boulders, removed materials rather than deposited materials. Apparently the ice accumulations did not remove enough material to expose fresh bedrock as did the ice materials on the Strongly Glaciated Lands. Some of these land types may also be the result of uplifting and subsequent increased erosion.

Bedrock-Characteristics - The granitic bedrock is mostly slightly fractured and moderately hard, somewhat weathered and spalling.

Vegetation - The vegetation is dominantly slow growing open stands of scrubby subalpine fir, lodgepole pine and white-bark pine overstory and the various sparse ground cover of mosses, occasional clump of (orbs and grasses and some low shrubs such as buckwheat and polygonum. The ground cover density is very low and ranges from 10 to 30 percent. The crown cover for the overstory ranges from 5 to 20 percent and 0 to 10 percent for the understory.

Soils - The dominant soils in this land type are 10 (50%), 11 (30%), 9c (20%). These soils are generally less than 24 inches to massive spelling bedrock. The 10 and 11 soils have loamy sand textures throughout, are non-stony and support very sparse stands of timber with very little ground cover. The 9c soil is on north slopes and supports somewhat denser stands of timber and herbaceous vegetation and has sandy loam textures throughout.

Management - Qualities These lands are poor aquifers and provide little subsurface moisture for sustained stream flow. The inherent erosion hazard for this land type ranges from moderate to moderately high. These lands with the more gentle slopes provide good location for road systems at lower elevations. The materials, however, are generally poorly graded and subject to erosion. The surface erosion hazard for cut and fill slopes and road surfaces range from moderate to moderately high and high. These lands, because of the high surface erosion hazard produce large amounts of sediments. Productivity potential for trees and herbaceous vegetation is very low. Stabilization of cut and fill slopes by vegetation is difficult because of the coarse textured materials and their low fertility. These lands are relatively easy to traverse by foot or horseback and contain many fine view points from which large expanses of aesthetically pleasing mountain topography can be viewed. The sparseness of vegetation permits relatively easy access and visibility.

Management - Evaluation

Vegetation - The dominant timber species are Douglas-fir, sub-alpine fir, lodgepole pine and white fir. The ground cover consists of elk sedge and grasses and densities range from 20 to 60 percent. The crown cover of the overstory is 10 to 30 percent and 10 to 20 percent for the understory.

Soils - The dominant soils on this unit are 9b (50%), lla (30%), and 8b (20%). The 9b soil has a bright colored sandy loam surface over sandy loam and loamy sand subsurfaces. The lla soil has loamy sand textures throughout. The 8b soil has dark colored sandy loam surface horizons over sandy loam subsurfaces. These soils are cobbly throughout the profile and are 30 to 40 inches to bedrock.

Management - Qualities The management qualities and hazards for this land type are similar to Weakly Glaciated Uplands (109). The inherent erosion hazard is moderate on this land type. However, because of the poor gradation the surface erosion hazard for cut and fill slopes is moderately high. Deep road cuts may intersect sub-surface flow and cause stability problems. Regen-eration of vegetation on cut and fill slopes will be much easier than on the dissected fluvial lands. These lands provide some important summer range for big game. Productivity potential for trees and herbaceous vegetation is moderate to moderately high.

Vegetation - The dominant timber species are Douglas-fir, sub-alpine fir, lodgepole pine and white fir. The ground cover consists of elk sedge and grasses and densities range from 20 to 60 percent. The crown cover of the overstory is 10 to 30 percent and 10 to 20 percent for the understory.

Soils - The dominant soils on this unit are 9b (50%), lla (30%), and 8b (20%). The 9b soil has a bright colored sandy loam surface over sandy loam and loamy sand subsurfaces. The lla soil has loamy sand textures throughout. The 8b soil has dark colored sandy loam surface horizons over sandy loam subsurfaces. These soils are cobbly throughout the profile and are 30 to 40 inches to bedrock.

Management - Qualities The management qualities and hazards for this land type are similar to Weakly Glaciated Uplands (109). The inherent erosion hazard is moderate on this land type. However, because of the poor gradation the surface erosion hazard for cut and fill slopes is moderately high. Deep road cuts may intersect sub-surface flow and cause stability problems. Regeneration of vegetation on cut and fill slopes will be much easier than on the dissected fluvial lands. These lands provide some important summer range for big game. Productivity potential for trees and herbaceous vegetation is moderate to moderately high.

FLUVIAL LANDS

The following land types have been mapped in this broad geomorphic group.

Name	Map Symbol	Acres	% of Area
River Spur Land	112	123	.1
Weakly Dissected Mountain Slope Land	120a	10,297	4.2
Moderately Dissected Mountain Slope Land	120b	36,413	14.9
Moderately Dissected Thin Mantled Mountain Slope Land	120b-1	20,528	8.4
Strongly Dissected Mountain Slope Land	120c	14,753	6.0
Strongly Dissected Thick Mantled Mountain Slope Land	120c-1	5,235	2.1
Steep Rocky Head Land	120d	4,336	1.7
Maturely Dissected Mountain Slope Land	120e	9,060	3.8
Steep Maturely Dissected Mountain Slope Land	120e-1	5,504	2.2
Structural Basin Land	121	403	.2
Maturely Dissected Structural Basin Land	121e	1,797	.7
Oversteepened Canyon Land	122	4,410	1.8
Faulted Bench Land	123	4,261	1.7
Total		117,120	47.9

As the name implies the dominant geomorphic process active on these lands is the erosive force of running water. This is not to say that other processes such as mass wasting, uplift and structural control have not contributed to the shape of these lands. These processes are largely responsible for such land types as Oversteepened Canyon Lands, Basin Lands and Faulted Bench Lands.

The most consistent characteristic common to all of the land types in this geomorphic group is that they are essentially unglaciated; have steep slopes (commonly greater than 60%); and are underlaid by moderately well to well weathered quartz monzonite bedrock which has a spelling nature when exposed to the atmosphere.

Photo 20

An overall view of the Fluvial Lands geomorphic group. The lands in the foreground and the center of the photo have been mapped Maturely Dissected Mountain Slope Land (120e).

Photo 21

Another typical view of the dissected Fluvial. Lands geomorphic group. The clear cut in the foreground was mapped Faulted Bench Land (123). The older Clear cuts were mapped Moderately Dissected Mountain Slope Land (120b).

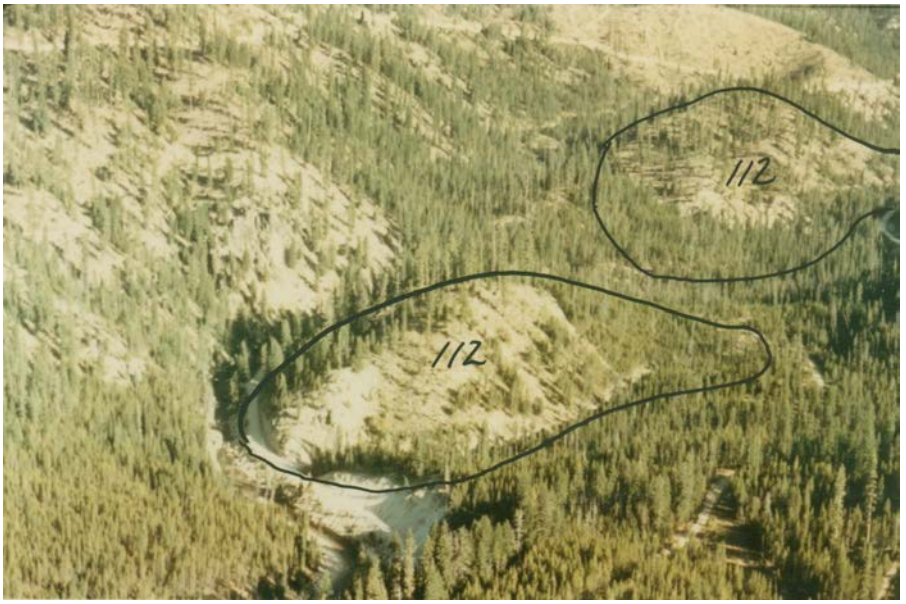
Photo 22

Typical rock outcrop on a dissected mountain slope. This particular type of rock outcrop would be a moderately spalling variety.

Photo 23

Another rock outcrop typical of the Fluvial Lands. This is a highly spalling variety. Note the subdued rounded shape of the rock. Road cuts in these kinds of rock are difficult to revegetate, and are long lasting sources of sediment.

RIVER SPUR LAND Map
Symbol 112



Location - Area near Penny Spring Recreation Site

Management Zone - River Breaks

Extent - Acres: 123
Percent of Area: .1

Topography - Slope Gradient: 45 - 60%
Aspect: Dominantly South and West
Elevation: 3000 - 4000'

Geomorphic Features - River Spur Lands are small, knoll like ridge remnants adjacent to the South Fork of the Salmon River. They occupy positions formerly occupied by the river itself. They were separated from the main slopes by the erosive forces of the river cutting through the least resistant rocks and fractures in the rock. The path cut by the river has undoubtedly been influenced considerably by the faulted characteristics of the canyon which opened fissures and zones of weakness for the passage of water. River Spur Lands are seldom more than 40 acres in extent.

Bedrock-Characteristics - The granitic bedrock is moderately well fractured and is moderately hard and somewhat leathered and is of a spalling variety.

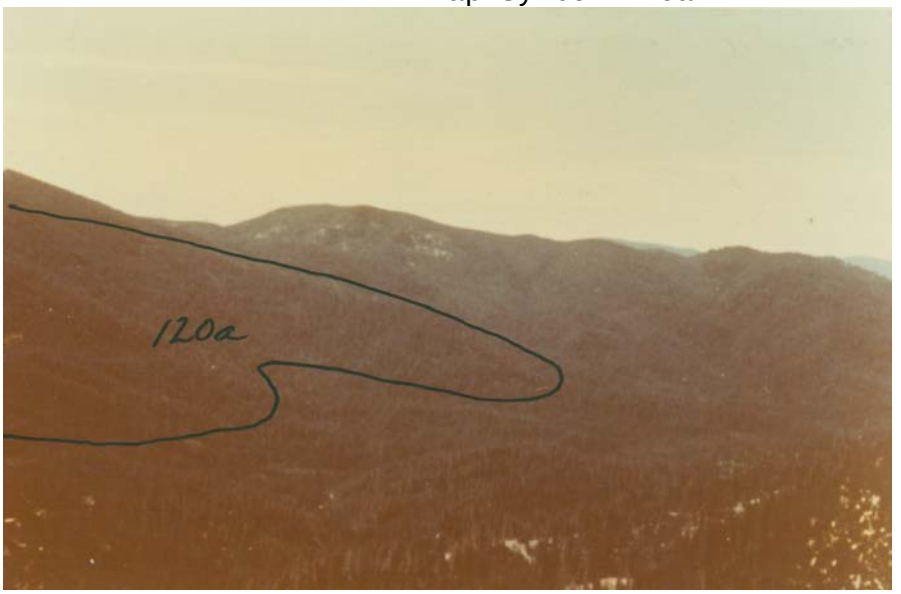
Vegetation - Dominantly sparse stands of ponderosa pine over grass. The ground cover densities range from 20 to 70 percent. The crown cover range from 5 to 25 percent for the overstory and 5 to 20 percent for the understory.

Soils - The dominant soils in this unit are 3 (30%), 16a (30%) and 1 (40%). The 3 soil has a dark colored surface horizon with loamy sand textures over loamy sand subsurface textures and is less than 20 inches to bedrock. The 16 soil has light colored loamy sand surfaces and is over loamy sand subsurfaces less than 20 inches to bedrock. The 1 soil has loamy sand textures throughout and generally averages 24 to 36 inches to massive bedrock.

Management Qualities - River Spur Land is one of the more unstable land types on the District. Because of the steep slopes and the closely adjacent river, roads will produce large amounts of sediment directly into the river. The inherent erosion hazard is moderately high and the erosion hazard for cut and fill slopes is moderately high to high. The debris slide hazard is moderately high and the mass stability hazard for fill slopes is moderately high. Timber and herbage productivity potential are generally low.

Management Evaluation -

WEAKLY DISSECTED MOUNTAIN SLOPE LAND
Map Symbol 120a



Location - Big Creek

Management Zone -Intermediate

Extent - Acres: 10,297
Percent of Area: 4.2

Topography - Slope Gradient: 4o - 55%
Aspect: North and East
Elevation: 4000 - 6000'

Geomorphic Features - These lands consist of mountain slopes that are incised by drainages greater than 1500 feet apart and entrenched in the slope at depths ranging from 10 to 30 feet deep. Drainages spaced closer than 1500 feet are generally less than 10 feet deep, drainages spaced at distances greater than 3000 feet may be greater than 30 feet deep. The fluvial process is the dominant slope forming process on these lands. This land type occasionally has evidence of weak glacial (periglacial) activities at the higher elevations.

Bedrock-Characteristics - The granitic bedrock is moderately well fractured, moderately hard, somewhat weathered to moderately soft, moderately weathered and spelling.

Vegetation - Most of the timber species on the District occur on this land type. The dominant ones are Douglas-fir, and ponderosa pine, larch and white fit also are common. The understory consists of brush and elk sedge and pine grass. The ground cover density for this unit ranges from 60 to 90 percent; the crown cover for the over-story ranges from 15 to 35; for the understory 15 to 30 percent.

Soils - The dominant soils on this land type are 17 (30%), 1 (35%), 15 (20%) and 9 (15%). The 11 and 9 soils generally occur at the higher elevations, with the 9 soils on the northerly exposed slopes and the 17 soils on the south aspects. The 17 soil has sandy loam surfaces over loamy sand subsurfaces and is non-stony throughout. The 9 soil has sandy loam surfaces over sandy loam and loamy sand subsurfaces. It may be stony or non-stony throughout. The 1 and 15 soils are found at the lower elevations. The 1 soils have sandy loam and loamy sand surface textures over loamy sand subsurface textures. The 15 soils have sandy loam surface textures over sandy loam subsurface textures. The average depth to bedrock in this unit is 36 to 60 inches. The 1 and 15 soils support the ponderosa pine timber species and the 17 and 9 soils support stands of Douglas-fir, white fir and larch.

Management - Qualities - The inherent erosion hazard of this unit is moderate. These lands are not as hazardous for road construction as are some of the more dissected lands because the slopes are not as steep and there are fewer drainages to cross with fills. However, there is a moderate to moderately high surface erosion hazard for cut and fill slopes. On the steeper portion of this land type the mass stability hazard for cut and fill slopes ranges from moderate to moderately high. This land type has a moderate to moderately high productivity potential for timber and herbaceous vegetation.

Management - Evaluation -

MODERATELY DISSECTED MOUNTAIN SLOPE LAND
Map Symbol 120b

Location - Dollar and Six-Bit Creeks

Management Zone - Intermediate

Extent - Acres: 36,413
Percent of Area: 14.9

Topography - Slope Gradient: 45-60%
Aspect: Dominantly North and East
Elevation: 3500 - 6000'

Geomorphic Features - These lands are dissected mountain slopes which are incised by drainages spaced generally between 500 and 1500 feet apart and entrenched in the slopes at depths ranging from 10 to 30 feet. Drainages spaced at distances greater than 1500 feet may be deeper than 30 feet and drainages spaced closer than 500 may be less than 20 feet deep.

Bedrock-Characteristics - The granitic bedrock is moderately fractured and the weathering ranges from moderately hard somewhat weathered to moderately soft moderately weathered. Much of the bedrock is the spalling variety.

Vegetation - Most of the timber species in the District occur on this particular land type, however, the dominant ones are Douglas-fir, ponderosa pine, over a shrub and grass ground cover. Larch and white fir are common at the higher elevations. The ground cover density ranges from 50 to 8o percent. The crown cover for the overstory ranges between 15 and 35, and 15 and 30 for the understory.

Soils - The dominant soils in this unit are 2 (40%), 3 (30%), 7 (15%) and 17 (15%). These soils are generally non-stony on the surface and throughout the profile. Average soil depth is 3 to 5 feet to bedrock. The number 2 soil has a dark colored loamy sand surface over a loamy sand subsurface. The number 3 soil has light colored loamy sand surfaces over loamy sand subsurfaces. The 7 soils have sandy loam to loam surfaces over sandy loam or loam subsurfaces.

Management Qualities - This land type supports a large percentage of merchantable timber on the District and much of these lands have already been logged. These lands with deep soils and slopes over 60 percent have exhibited a moderate to moderately high hazard for road fill failures. The surface erosion hazard for road cuts and fills on this unit is moderate to moderately high and mass stability hazard for cuts and fills is moderate to moderately high. The inherent erosion hazard for this land type ranges from low to moderate. This land type has a moderate to moderately high productivity potential for timber and herbaceous vegetation.

Management Evaluation -

MODERATELY DISSECTED THIN MANTLED
MOUNTAIN SLOPE LAND Map
Symbol 120b-1

Location - Dollar and Six-Bit Creeks

Management Zone - Intermediate

Extent - Acres: 20,528
Percent of Area: 8.4

Topography - Slope Gradient: 40-55%
Aspect: Generally South and West
Elevation: 3500 - 5500'

Geomorphic Features - Similar to Moderately Dissected Mountain Slope Land (120b) except that this unit is somewhat more deeply dissected and has a much thinner soil mantle. Drainages are spaced generally between 500 and 1500 feet apart and entrenched in the slopes at depths ranging from 10 to 30 feet. Drainages spaced at distances greater than 1500 feet may be deeper than 30 feet and drainages spaced closer than 500 feet may be less than 20 feet deep. A major inclusion in this land type is Moderately Dissected Mountain Slope Land (120b).

Bedrock Characteristics - The granitic bedrock is moderately well fractured and the weathering ranges from moderately hard somewhat weathered to soft and well weathered. The granitic bedrock on the unit is usually the spalling variety.

Vegetation - The dominant vegetation on this land type is ponderosa pine, over pine grass, snowberry and in some areas ninebark. The ground cover on this unit averages between 25 and 45 percent. The crown cover for the overstory is 10 to 25 percent. The understory 10 to 20 percent.

Soils - The dominant soil in this unit is 3 (30%), 1 (30%), and 15 (20%), and 4 (20%). The 3 soil is shallow, being less than 20 inches to bedrock with loamy sand surfaces over loamy sand subsurfaces. The 1 soil is very similar to the 3 soil except that it is more than 20 inches to bedrock; averaging about 30 inches. The 15 soils have sandy loam surfaces over sandy loam subsurfaces and average 30 to 40 inches to bedrock. These soils are nonstony throughout the profile. The 4 soil is nonstony, has sandy loam and loamy sand textures throughout and is less than 20 inches to highly weathering bedrock. The soils on this unit differ from the 120b unit in that they are lighter colored and generally somewhat coarser textured. and shallower.

Management - Qualities This unit, although it produces moderate stands of ponderosa pine will create some rather severe problems in road construction. The inherent erosion hazard is moderately high to high and the surface erosion hazard for road cuts and fills is moderate to moderately high and high. Revegetation of cut and fill slopes would be very difficult. The wet and dry creep hazard on this is is moderately high in many places. When these land types have been logged in the past they have produced some of the highest volumes of sediment of any of the land types in the area. Using ordinary logging methods such as a jammer system it would be very difficult to log these particular land types without producing excessive amounts of sedimentation to the stream and subsequent watershed damages.

Management - Evaluation

MODERATELY DISSECTED MOUNTAIN SLOPE LAND
MODERATELY-DEEP AND DEEP LOAMY-SKELETAL SOILS

Map Symbol 120b-10

Location and Extent. Intermediate management zone. Norton Creek, IPA.

Acres - 24,654 Percent of Area - 5.5

Landtype Characteristics. These lands are dissected mountain slopes that are incised by drainageways spaced 600 to 1,500 feet apart and entrenched 10 to 30 feet in the slopes. Deeper drainages occur in the unit but are spaced more than 1,500 feet apart. The topography is the result of fluvial action and existing slopes are convex, have slope gradients of 45 to 70 percent and range from 600 to 1,500 feet in length. They are on all aspects and have a vegetative cover of timber. Elevations range from 5,500 to 7,000 feet. The dominant soils are deep and moderately deep and are underlain by andesite and rhyolite bedrock at depths of 20 to 50 inches.

Soils. The soils in this landtype have a thin, 1-to-2-inch organic layer on the surface. About 60 percent of the soils have a thin dark colored sandy loam surface and a gravelly sandy loam subsoil with 35 to 60 percent gravel and cobble. These soils are moderately deep and deep and occupy the higher areas in the landtype. Forty percent of the soils are soils are moderately deep, have a dark colored gravelly loam surface and a brown gravelly clay loam subsoil, with 40 to 60 percent coarse fragments. Shallow gravelly sandy loam soils are common on ridge crests, ridge spurs and south slopes.

Vegetation. Habitat types identified in this unit are Douglas-fir - snowberry and Douglas-fir - ninebark habitat types. At higher elevations subalpine fir-grouse whortleberry is common, and on the south slopes ponderosa pine-wheatgrass type is present. Present vegetation consists of Douglas-fir and ponderosa pine with an understory of snowberry, ninebark, thin leaf huckleberry, pinegrass and wheatgrass. At higher elevations subalpine fir, grouse whortleberry and related species are common. Forest crown density varies from 30 to 60 percent. Brush crown density is 30 to 40 percent. Ground cover varies from 60 to 80 percent.

Slope Hydrology. Most of the runoff is by moderately deep subsurface flow which tends to concentrate in the concave drainages.

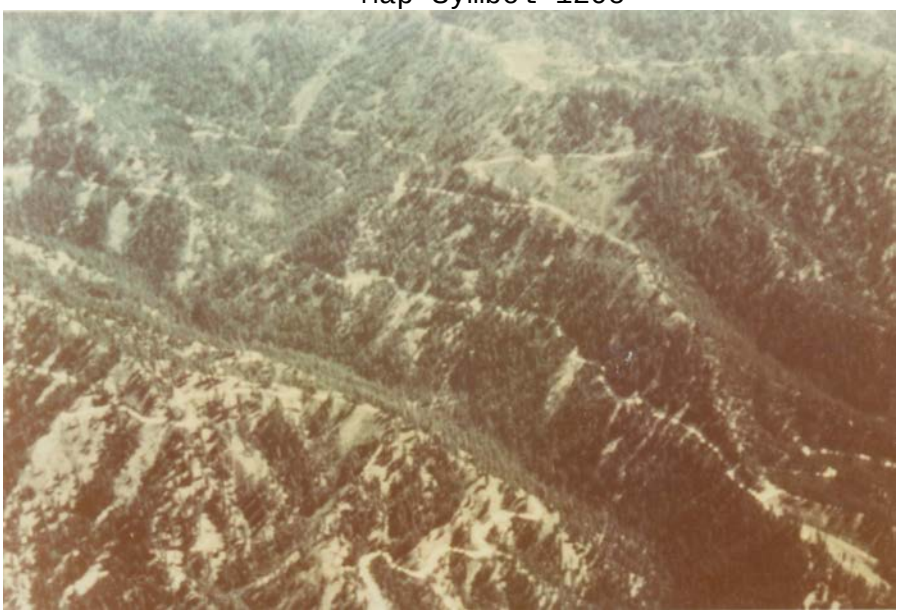
Management Qualities. Although slopes are steep these lands are moderately stable. Soil disturbance and road construction impacts are usually moderate. Timber productivity potential is moderate to high.

Limitations for reforestation are moderate primarily due to vegetative competition. Forage production potential is moderate to high for both domestic livestocks and big, game animals.

Activities	Road Standard		Logging Methods								Domestic Grazing Systems		Wild Fire
			Partial				Clear Cutting						
Impacts	High	Low	Cat Logging		Skyline	Balloon	Cat Logging	High Lead	Skyline	Balloon	Rest Rotation or Deferred	Other	Uncontrolled
Mass Wasting	3	3	-		3	1	-	3	3	3	2	2	3
Sedimentation	3	3	-		3	1	-	3	3	2	2	2	2
Surface Erosion	3	2	-		2	1	-	2	2	2	2	3	2
Runoff Rate	4	3	-		3	1	-	3	2	2	2	2	2

Management Evaluations.

STRONGLY DISSECTED MOUNTAIN SLOPE LAND
Map Symbol 120c



Location - Sixteen-to-One Creek, Trail Creek

Management Zone -River Breaks and Intermediate

Extent - Acres: 14,753
Percent of Area: 6.0

Topography - Slope Gradient: 50-65%
Aspect: Dominantly South and West
Elevation: 3500 - 5500'

Geomorphic Features - These are streamcut mountain slope lands and are incised by drainageways spaced 500 feet or less apart with a depth of 20 feet or less. Some of the lands are more deeply entrenched by drainages up to 1500 feet apart.

Bedrock-Characteristics - The granitic bedrock on this land type is slightly to moderately well fractured and the weathering ranges from moderately hard somewhat weathered to soft well weathered and is generally the spalling variety.

Vegetation - The dominant vegetation is ponderosa pine with a ground cover of pine grass and ceanotius and other brush species. The ground cover densities on this unit range from 5 to 25 percent for the overstory and 10 to 20 percent for the understory.

Soils - The dominant soils on this unit are 3 (30%), 1 (50%) and 4 (20%). The 3 and 4 soils are less than 20 inches to bedrock and have loamy sand textures throughout. The 1 soil is 20 to 40 inches to bedrock and has loamy sand textures throughout. The 4 soil is less than 20 inches to highly weathered granitic bedrock. It has loamy sand textures throughout. The 3 soil is found mostly on the upper slopes and ridge tops and the 4 and 1 soils are generally found on the mid slope and lower slope positions.

Management - Qualities These lands exhibit some of the most severe hazards for logging activity and road building on the District. Because of the shallow nature of the soils and the highly weathered and spalling bedrock and steep slopes the erosion and stability hazards are moderately high for most of this unit. These lands have in the past produced large amounts of sediment in connection with road construction and logging activities. The avalanche hazard on this unit at high elevations is high. These lands have moderate to moderately high runoff rates and produce considerable amounts of sediment to the streams from natural geologic erosion. Road cuts and fills on these land types are quite difficult to stabilize with vegetation because of the inherent low fertility of the soils and the droughtiness of the site. Also, chances for seedling regeneration on these slopes is poor.

Management - Evaluation

STRONGLY DISSECTED THICK MANTLED MOUNTAIN SLOPE LAND

Map Symbol 120c-1

Location - Clear Creek, Beaver Creek, Grouse Creek

Management Zone - Intermediate

Extent - Acres: 5,235
Percent of Area: 2.1

Topography - Slope Gradient: 50-70%
Aspect: North and East
Elevation: 3500 - 5500'

Geomorphic Features - They are similar to Strongly Dissected Mountain Slope Land (map symbol 120c). This land type is incised by somewhat parallel drainageways spaced 500 feet or less apart and to a depth of 20 feet or less. Some land types ere more deeply entrenched by drainages up to 1500 feet apart. This land type also has a thicker soil mantle than does 120c.

Bedrock Characteristics - The granitic bedrock on this land type is slightly to moderately fractured and moderately hard, somewhat weathered and spalls.

Vegetation - The dominant timber species are ponderosa pine, Douglas-fir with an understory of brush and pine grass. The ground cover densities range from 50 - 70 percent. The crown cover for the overstory is 15 - 30 percent and 15 to 30 percent for the understory.

Soils - The dominant soils in this land type are 3 (30%), 1 (40%),,15 (20%). The 3 soil is dominantly less than 20 inches to bedrock and has loamy sand subsurface textures. The 1 soil averages 30 to 40 inches to bedrock and has loamy sand textures throughout. The 15 soil averages 30 - 50 inches to bedrock and generally has sandy loam surface textures, and sandy loam or loamy sand subsurface textures. The 3 soil is generally located on the ridge tops and upper side slopes and the 1 and 15 soils are located in mid-slope and lower slope positions.

Management Qualities - The management qualities and hazards for this unit are similar to those for 120c. The mass stability hazard for fill and cut slopes is higher than 120c. Road construction problems are related to road fill failures in the draws. The surface erosion hazard is somewhat less. The hazard of intercepting subsurface flow on this land type is high. Timber and herbage productivity potential is moderate.

Management Evaluation -

STEEP ROCKY HEADLAND
Map Symbol 120d

Location - Cougar Rock Area

Management Zone- Intermediate or River Breaks

Extent - Acres: 4,336
Percent of Area: 1.7

Topography - Slope Gradient: 65 - 75%
Aspect: All
Elevation: 4000 - 6000'

Geomorphic Features - This land type comprises the dendritic headlands of minor drainages in the Fluvial Lands.

Bedrock-Characteristics - The granitic bedrock is slightly to moderately well fractured and the weathering ranges from moderately hard to somewhat weathered and both spalling and non-spalling varieties are present.

Vegetation - The vegetation consists of very sparse stands of ponderosa pine over pine grass and ceanothus. Ground cover density ranges from 10 to 30 percent and the crown cover ranges from 5 to 15 percent for the over-story and 5 to 20 percent for the understory.

Soils — The dominant soils in this unit are 16 (50%), 1 (20%) with most units averaging about 30 percent rock outcrop. The 16 soil has a light colored loamy sand. surface over a loamy sand subsurface and is generally less than 20 inches to bedrock. The 1 soil has loamy sand surface textures over loamy sand subsurface textures and averages about 30 inches to bedrock.

Management - Qualities — This unit would cause very severe problems for road construction. The inherent erosion hazard for this unit is high. The surface erosion hazard for road cuts and fills and the mass stability hazard for road cuts and fills is moderately high and high. This unit has the highest natural rates of erosion of any of the land types on the District. The timber productivity potentials are low to moderately low.

Management - Evaluation

MATURELY DISSECTED MOUNTAIN SLOPE LAND
Map Symbol 120e

Location - Foolhen Creek and the South Fork of the Gold Fork River

Management Zone - Intermediate

Extent - Acres: 9,060
Percent of Area: 3.8

Topography - Slope Gradient: 30 - 45%
Aspect: All
Elevation: 4500 - 5500'

Geomorphic Features - This land type typically has a rather finely meshed dendritic drainage pattern with rounded ridge tops and broadly concave shaped drainage bottoms. Such a pattern indicates a more maturely developed topography than the typically sharp ridges and V-shaped valleys of the Fluvial Lands. Also, included in this designation are maturely developed complex landscapes which have been modified in places by river deposits laid down by ancient meanderings of the river which has since entrenched itself leaving the deposits behind on the slope to be devloped by the slope-forming processes in existence.

Bedrock-Characteristics - The granitic bedrock is generally slightly to moderately well fractured and the weathering ranges from moderately soft to moderately weathered to soft well weathered. The granitic bedrock is dominantly of the spalling variety.

Vegetation - The vegetation consists of ponderosa pine and Douglas-fir with understories of brush, shrubs and pine grass. The ground cover densities range from 40 to 70 percent. The crown cover overstory ranges from 15 to 35 percent and 10 to 25 percent for the understory.

Soils - The dominant soils in this land type are 1 (30%), 3 (20%), 14 (20%) and 4 (30%). The 1 and 3 soils have loamy sand surfaces and subsurfaces and the 1 soil is 20 to 40 inches to bedrock and the 3 soil is less than 20 inches to bedrock. The 4 soil has loamy sand or sandy loam textures throughout and is less than 20 inches to highly weathered bedrock. The 14 soil has sandy loam surfaces over subsurfaces with textural B2 horizons of sandy loam to sandy clay loam textures. This soil also overlies highly weathered bedrock.

Management - Qualities - These lands have a moderate to moderately high productivity potential for timber and herbage production. The inherent erosion hazard on this unit is moderate. Due to poor gradation road construction problems are generally related to backslope failures and the construction of stable fills across draws. Unless great care is taken road construction and logging activities in some areas on this land type can produce very high amounts of sediment to the stream.

Management - Evaluation

STEEP MATURELY DISSECTED MOUNTAIN SLOPE LAND
Map Symbol 120e-1

Location - Upper Pearsol and Foolhen Creeks

Management Zone- Intermediate

Extent - Acres: 5,504
Percent of Area: 2.2

Topography - Slope Gradient: 40-55%
Aspect: South
Elevation: 5,000 - 6,500'

Geomorphic Features - This land type is similar to Maturely Dissected Mountain Slope Land (120e). It has a finely meshed dendritic drainage pattern with rounded ridge tops and broad concave shaped drainage bottoms. This pattern indicates a more maturely developed topography than the sharp ridges and V-shaped valleys of some of the other Fluvial Lands. These lands differ from the Maturely Dissected Mountain Slope Lands in that they have been oversteepened. This oversteepening has been mainly due to faulting and uplift.

Bedrock-Characteristics - The granitic bedrock on this land type is slightly to moderately well fractured and the weathering range from moderately soft to soft well weathered. The bedrock is the spalling variety.

Vegetation - The dominant timber species are ponderosa pine, Douglas-fir and some white fir. The understory is mostly brush, shrubs and pinegrass. The ground cover density ranges from 35 to 55 percent. The crown cover for the overstory is 15 - 25 percent and 10 to 20 percent for the understory.

Soils - The soils on this land type are 1 (40%), 4 (30%), and 3 (30%). The 1 and 3 soils have loamy sand surfaces and subsurfaces. The 1 soil is 20 to 40 inches to bedrock and the 3 soil is dominantly less than 20 inches to bedrock. The 4 soil has loamy sand or sandy loam textures throughout and is less than 20 inches to soft well weathered bedrock.

Management - Qualities Road construction and logging activities on this land. type may produce very high amounts of sediment to streams. Problems with road construction are related to construction of stable fills across draws and surface erosion of the cut and fill slopes. This is due partially to the poor gradation of the particle sizes. Road densities will be an important factor on this land type. The inherent erosion hazard for the unit is moderate and the dry creep hazard is moderately high. These lands have a moderate productivity potential for timber and herbage production.

Management - Evaluation

Map Symbol 120b-4
Moderately Dissected Mountain Slope Land
Moderately Deep and Deep Coarse Loamy and Loamy Skeletal Soils

Location: Typical locations on the Idaho City Ranger District are west of Warm Springs Gulch, and east of Grimes Creek at Wildhorse Creek.

Landtype Characteristics: The slope forming process on Moderately Dissected Mountain Slope Land is the action of running water. Slopes have been moderately incised by stream cutting and intermittent concentrations of overland flow. The slopes of this landtype are north-facing, heavily timbered, convex, 40 to 65 percent gradient, 500 to 2000 feet long, and are mapped at elevations of 3500 to 6500 feet. The moderately deep, loamy skeletal soils are underlain by relatively soft, moderately well to well weathered granite with masked fracturing.

Soils: The dominant soils on this landtype (65%--IFDA-5) are moderately deep and have an organic layer 1 to 2 inches thick. The surface soil is a very dark grayish brown gravelly sandy loam with 20 to 40 percent gravel and 0 to 10 percent rock. The subsoil is a dark brow gravelly sandy loam to gravelly sandy clay loam with 20 to 50 percent gravel, and 0 to 30 percent rock. These soils are found on all side-slope positions. Other soils (20%--IFDA-4) are similar but have less than 35 percent gravel in the profile. A shallow soil found on upper slopes, ridge crests and spurs has characteristics similar to the dominant soil.

Vegetation: The slopes of this landtype are well vegetated, with the following habitat types dominant: Douglas-fir/elk sedge, ninebark and Douglas-fir/spirea on all positions, and Douglas-fir/mountain maple on some mid and upper slopes. Vegetative ground cover for the landtype ranges from 80 to 100 percent. Forest crown density is 50 to 90 percent and brush crown density is 15 to 40 percent.

Hydrology: Mean annual precipitation is 20 to 40 inches and mean water yield is 5 to 15 inches. Snowpacks are moderate and persist well into May. Major runoff is from snowmelt and occurs in a few weeks in April and May. Overland flow is extremely rare and runoff is about evenly divided between moderately deep subsurface flow above bedrock, and percolation through bedrock. Outflow rate of water delivered to the landtype is moderate to slow. Lower slopes and concave incipient draws have greater quantities of subsurface flow than upper slopes and convex ridges.

Management Qualities: These Moderately Dissected Mountain Slope Lands are north facing and well vegetated. The moist micro-climate contributes to the high productivity of this landtype.

Roads. This landtype will not be as hazardous as many other lands for road locations. However, specific hazards do exist that must be considered. Where bedrock is fractured, deep percolation of the water will be the rule. The likelihood of cut slopes intercepting subsurface flow is reduced except on the steepest slopes and at the base of major draws where fracturing is masked and the bedrock is well weathered, deep percolation of water will be restricted and the hazard of cut and fill failures will be increased. Well weathered bedrock is also a poorly graded source of fill material. The degree of hazard associated with the moist micro-climate and bedrock will be reduced by confining locations to upper slopes. Revegetation potential for cut slopes is moderate to high. Trafficability is good to fair.

Wood. These units are among the most productive on the District. Relative ratings for the habitat types are moderate to high. Limitations to reforestation are slight to moderate and are related to vegetative competition.

Water. A high hazard for serious alteration of the hydrology of landtype exists on the mid and lower slopes from cuts and fills. Subsurface flow is heavy and subject to interception during spring runoff. Fills and their sub-base, and some cuts, are subject to saturation and loss of strength. The hazard for serious increase in sedimentation is correspondingly high. Hazards to hydrology are moderate on upper slopes, convex slopes and ridges, and on lower slopes under 45 percent.

Forage. The potential production for this landtype is 200 to 800 pounds per acre per year of usable dry forage. Impact from overgrazing is accelerated surface erosion.

Recreation. Recreation potential is mainly related to esthetics and a forested appearance. The landtype is not suitable for campgrounds, but other forms of recreation such as interpretive trails, backpacking, hiking, hunting and fishing can be managed for.

Management Evaluation:

STRUCTURAL BASIN LAND
Map Symbol 121

Location - Upper Deep Creek

Management Zone - Intermediate

Extent - Acres: 403
Percent of Area: .2

Topography - Slope Gradient: 20 - 40%
Aspect: All
Elevation: 4000 - 5500'

Geomorphic Features - Structural Basin Land consists of land which has been modified or displaced from its original position by faulting activities and presently occupies a lower position than it did at one time. Most of these lands have, after faulting, because of their lower position, accumulated materials from higher elevations. Some of these lands are still accumulating material.

Bedrock Characteristics - The granitic bedrock is slightly to moderately well fractured and moderately hard, somewhat weathered to moderately soft and moderately weathered and much of the granitic bedrock is of the spalling variety.

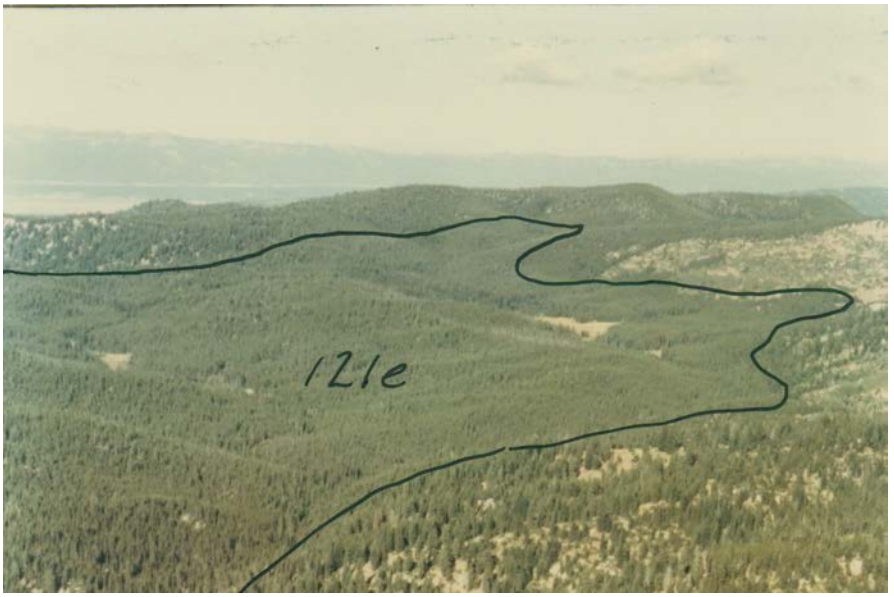
Vegetation - The vegetation in this unit consists of Douglas-fir, ponderosa pine with some areas of white fir. The understory consists of shrubs, pine grass and tall huckleberry. The ground cover density is from 50 to 80 percent. The crown cover density ranges from 15 - 35 percent for the overstory 10 - 30 percent for the understory.

Soils - The dominant soils in this unit are 1 (40%), 15 (30%) and 14 (20%). The 1 soil has loamy sand textures throughout and generally is deeper than 36 inches to bedrock. The 15 soil has loamy sand or sandy loam surface textures over sandy loam subsurface textures and is generally 36 to 48 inches to bedrock. The 14 soil has sandy loam surface textures over sandy loam to sandy clay loam subsurface textures and is 30 to 40 inches to well weathered bedrock.

Management Qualities - These lands are among the most highly productive for timber on the District and have relatively low hazards to logging and road construction. The inherent erosion hazard for this land type would be moderately low to moderate.

Management Evaluation -

MODERATELY DISSECTED STRUCTURAL
BASIN LAND
Map Symbol 121e



Location - Stoney Meadows

Management Zone- Intermediate

Extent - Acres: 1,797
Percent of Area: .7

Topography - Slope Gradient: 35 - 55%
Aspect: All
Elevation: 4500 - 6500'

Geomorphic Features - These lands are similar to Structural Basin Land (121). This land has been modified or displaced from its original position by faulting activities and presently occupies a lower position than it did at one time. This land differs from unit 121 in that they are well along in the erosion cycle and are presently well incised with a dendritic drainage pattern. As a result this land is not accumulating materials as is unit 121.

Bedrock-Characteristics - The granitic bedrock is mostly slightly to moderately well fractured and the weathering ranges from moderately hard somewhat weathered to soft and well weathered. The granitic bedrock is generally of the spalling variety in this unit.

Vegetation - The dominant tree species are Douglas-fir, ponderosa pine with some white fir and Engelmann spruce. The ground cover consists of pine grass, tall huckleberry and other shrubs. The ground cover density ranges from 30 to 70 percent. The crown cover for the over-story is 10 to 25 percent and 5 to 25 percent for the understory.

Soils - The dominant soils on this unit are 3 (25%), 1 (35%) 15 (20%), 14 (20%). These soils are the same as the ones mapped on Structural Basin Land (121) except for the 3 soil which has loamy sand surface textures and sub-surface textures and generally is less than 20 inches to massive spalling granitic bedrock. The soils on this unit are generally shallower to bedrock than are the soils for Structural Basin Land.

Management Qualities - The management qualities for this unit are similar to that of Structural Basin Land (Map Symbol 121) except that the erosion hazard is higher on this unit because of the drainage pattern development and thus would have more opportunity for carrying sediment to the drainages. The inherent erosion hazard in this unit is moderate to moderately high. The surface erosion hazard for cut and fill slopes range from moderate to moderately high and the surface erosion hazards for a 6 percent road grade would range from moderate to moderately high. The timber productivity and herbage productivity potential for this unit are somewhat lower than that of Structural Basin Land (Map Symbol 121). This land type generally produces more sediment from natural erosion than does the 121 unit.

Management Evaluation -

OVER STEEPENED CANYON LAND

Map Symbol 122

Location - Areas adjacent to the South Fork of the Salmon River

Management Zone - River Breaks

Extent - Acres: 4,410
Percent of Area: 1.8

Topography - Slope Gradient: 65 - 75%
Aspect: All
Elevation: 3500 - 4500'

Geomorphic Features - Oversteepened Canyon Lands are steep to extremely steep, moderately to strongly dissected mountain slopes immediately adjacent to the South Fork of the Salmon River and the Middle Fork of the Payette River. The chief common characteristic of these lands is their steepness and their contact with the river. Another similarity is that these lands contain second or third order drainages which are in contact with the main drainages. The common characteristic being that there is a gap of 2 to 4 stream orders between the drainage on the slope and the main drainage.

Bedrock-Characteristics - The granitic bedrocks on south slopes generally are massive to slightly fractured and range in weathering from moderately hard to somewhat weathered to moderately soft and moderately weathered and generally are of a spalling variety. The granitic bedrock on north slopes is dominantly moderate to moderately well fractured and generally moderately hard and somewhat weathered and normally is the non-spalling variety.

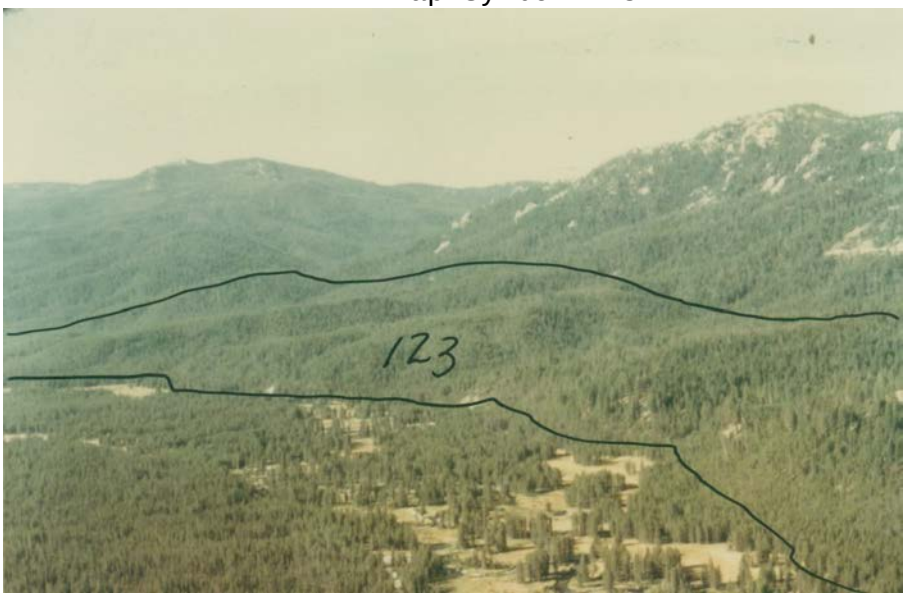
Vegetation - The vegetation on south slopes consists of sparse stands of ponderosa pine over pine grass. The ground cover on the south slopes generally ranges from 15 to 30 percent. The vegetation on the north slopes is generally Douglas-fir and ponderosa pine with brush understory having densities of 40 - 70 percent. The crown cover for the unit range from 5 - 15 percent for the overstory and 0 to 40 percent for the understory.

Soils - The dominant soils on this unit are 3 (30%), 16 (30%), 1 (30%) and rock outcrop 10 percent. The 3 and 16 soils are less than 20 inches to bedrock and have loamy sand surfaces and subsurfaces. The 3 soil occurs on the north slopes and the 16 soils occur on the south slopes. The 1 soil has loamy sand subsurfaces and is generally found on south slopes. The average depth to bedrock in this unit is generally less than 20 inches.

Management - Qualities - These lands are among the most geologically unstable lands in the survey area. They have one of the highest natural geologic erosion rates on the survey area. The inherent erosion hazard of this unit range from moderately high to high. The erosion hazard and mass stability hazard for road construction on these kinds of lands generally range from moderately high to high for all aspects. This unit also has one of the highest hazards for debris slides of any land type in the survey area. Building stable roads on these land types will be very difficult and impacts will be high because of the adjacent river. The timber and herbage production potential for this unit is low and moderately low.

Management - Evaluation -

FAULTED BENCH LAND
Map Symbol 123



Location - Area between Cougar Rock and Stolle Meadows

Management Zone - Intermediate

Extent - Acres: 4,261
Percent of Area: 1.7

Topography - Slope Gradient: 30 - 50%
Aspect: Mostly North and East Elevation: 4500 - 6500'

Geomorphic Features - These lands comprise a special group of lands which are remnants of block faulting activity on the District. The block faulting activity results in low bench-like ridge systems which in many cases have been modified by glacial outwash deposits and have been moderately to weakly dissected.

Bedrock-Characteristics - The fracturing of the granitic bedrock ranges from slightly to moderate well fractured and the weathering ranges from moderately soft moderately weathered to soft and well weathered.

Vegetation - The dominant tree species are Douglas-fir, white fir, and ponderosa pine. The understory is generally brush, tall huckleberry and elk sedge and pine grass. The ground cover densities range from 50 - 80 percent. The crown cover for the overstory range from 15 - 35

percent and 15 - 30 percent for the understory.

Soils - The soils on this unit are 1 (30%), 9 (25%), 15 (25%) and 14 (20%). The 1 soil is 36 inches to 48 inches to bedrock and has loamy sand textures throughout. The 9 soil has sandy loam and loam surfaces over sandy loam and loamy sand subsurfaces and is generally 36 inches or more to well weathered bedrock. The 9 soil is found at the higher elevations. The 15 soil has sandy loam textures throughout and it is 36 to 48 inches to bedrock. The 14 soil has sandy loam or loam surface textures and sandy loam to sandy clay loam subsurface textures and is 30 to 40 inches to well weathered bedrock.

Management Qualities - Timber productivity and herbage productivity for this unit is moderately high. The inherent erosion hazard is moderate and the surface erosion hazard for road cuts, fills and road surfaces range from moderate to moderately high. The fill slope mass stability hazard ranges from moderate to moderately high also. Because of the well weathered nature of the bedrock road construction on the steeper slopes in this unit would result in moderately high amounts of sediment to the drainages.

Management - Evaluation

DEPOSITIONAL LANDS

The following land types are included in this geomorphic group:

Name	Map Symbol	Acres	% of Area
Alluvial Land	101	3,942	1.6
Terrace Land	102	166	.1
Glacial Outwash Land	103	4,520	1.9
Valley Train Land	104	6,646	2.7
Alluvial Fan Land	105	1,043	.4
Moraine Land Undifferentiated	106	2,610	1.1
Lateral Moraine Land	106a	1,298	.5
End Moraine Land	106b	941	.4
Total		21,166	8.7

The term Depositional Lands, as used in this report includes those lands formed from water and glacial deposits adjacent to the main South Fork of the Salmon River and to the tributary drainages below the zone of alpine glaciation. An exception to this is the Valley Train Land units which are included in this grouping because of their depositional nature even though they are found in the zone of alpine glaciation.

Depositional land types are composed of many different kinds of soils supporting different kinds of vegetation. These are discussed in more detail under the description of individual land types. They all, however, generally occupy the lower position in the landscapes. There are Many gentle slope gradients which tend to be nearly flat. Nearly all are adjacent to, or at least near to, streams. Soils are dominantly deep to extremely deep (25 feet to bedrock is not exceptional on some terrace lands) and are the most mineralogically mixed in the survey area.

Hydrologically these lands provide only a small percentage to total stream flow (water yield is 5-15% but serve as aquifers of storage reservoirs for ground water and subsurface flow from adjacent higher lands.

Much of this land offers excellent routes for road locations providing wet spots are filled and high cuts are avoided. The materials adjacent to streams on these lands is subject to washing and sensitive to encroachment of streams from the opposite bank.

Productivity for timber varies from very low on some glacial outwash lands to very high on some terrace and alluvial lands. Productivity for herbaceous vegetation has about the same variability (low to high).

Photo 24

A typical soil found in Valley Train Lands at high elevations. These soils have sandy loam or loamy sand textures throughout. They are stony on the surface and the subsurface. These soils act as buffers in controlling runoff from the steep adjacent Glacial Trough Lands.

ALLUVIAL LAND
Map Symbol 101

Location - The low lands adjacent to the South Fork of the Salmon River

Management Zone - Mostly Travel or Water Influence

Extent - Acres: 3,942
Percent of Area: 1.6

Topography - Slope Gradient: 0 - 5%
Aspect: All
Elevation: Dominantly 3000 - 4000'

Geomorphic Features - Alluvial lands are those lands immediately adjacent to streams and include river wash, bottom lands, and first terrace land positions. The alluvial lands are also mapped in the high mountain meadows and generally have a high water table at least in the spring of the year.

Bedrock-Characteristics - This is a depositional land type and generally it is quite deep to bedrock. Normally these land types are at least 10 feet to bedrock and may be as deep as 100 feet or more.

Vegetation - The vegetation on this unit, because of the wide elevational range, is quite variable. The vegetation at the lower elevation consists mostly of ponderosa

pine with some areas having Douglas-fir. The understories are generally pine grass and some of the warmer brush species. The ground covers at the lower elevations range from 30 - 60 percent. The crown cover densities range from 15 - 30 percent for the overstory, 20 - 50 percent for the understory. The vegetation at the higher elevation consists of lodge pole pine and spruce overstories with understories of sedges and other meadow-like vegetation. The ground cover on these meadows generally is near 100 percent.

Soils - Because of the depositional nature of this land type soils are quite variable. The dominant soils at the lower elevations are 12 (70 percent), 12a (30%). The soils in the high mountain meadows were not identified because of the very small extent of these lands. Generally speaking, the soils in the meadow lands have thick dark sandy loam to loam surface horizons over lighter colored sandy loam and loam subsurface horizons. The 12 soil has loamy sand textures throughout and the 12a soil has loamy sand textures throughout, however, is stony throughout the profile. These soils are 6 feet or more to bedrock.

Management-Qualities Engineering problems in this unit are mainly involved with stream encroachment in the bearing capacity of road prisms. Some of these lands will require considerable ballast to provide the bearing strength necessary for expected wheel loads during the wet season. These lands also provide an effective buffer from the sediment from the above slopes. The soils in these land types have a moderate to high productivity potential for timber and herbaceous vegetation.

Management - Evaluation

TERRACE LAND
Map Symbol 102

Location - Small areas along the South Fork of the Salmon River.

Management Zone - Mostly Travel or Water Influence

Extent - Acres: 166
Percent of Area: .1

Topography - Slope Gradient: 5 15%
Aspect: All
Elevation: 3500 - 4500'

Geomorphic Features - Terrace Lands designate deposits of flat to gently sloping lands which were deposited by the major drainages which have since been entrenched and dissected to the point where there are only relatively small remnants of a landform which was formerly much larger. These river terraces were probably deposited as glacial outwash during one of the Pleistocene periods and are left in their presently elevated positions by stream entrenchments. Many units of this land type were too small to map out with the scale of photographs that were used for this survey. Small pockets of terrace materials are found on the lower toe slope positions in many places along adjacent slopes in River Spur Lands but have been eroded to the point where they have become a part of the slope.

Bedrock-Characteristics — This is a depositional land type and generally it is quite deep to bedrock. Normally these land types are at least 10 feet to bedrock and may be as deep as 100 feet or more.

Vegetation - Timber species on these units are ponderosa pine and Douglas-fir. Understories are ceanothus, snowberry, willow, prunis and huckleberry and pine grass. Ground cover densities range in percent from 60 to 90 percent. Crown cover densities for the overstory range from 20 to 30 percent and 30 to 50 percent for the understory.

Soils - The dominant soils on this unit are 12 (60%), 12a (20%), 5 (20%). The 12 and 12a soils have loamy sand surface textures over loamy sand subsurface textures. The 12a soil has more than 35 percent by volume of coarse fragments in the profile. The 5 soil has sandy loam or loamy sand textures throughout. All soils in this unit are more than 6 feet to bedrock.

Management - Qualities — These lands because of their favorable topography adjacent to main access routes provide the most favorable sites for administrative areas, air strips, campground. The River Terrace Lands like the Glacial outwash and Moraine Lands generally provide little hazard to road building, except in the back slopes which have a moderately high surface erosion hazard on the steeper slopes. The inherent erosion hazard for this unit is moderately low. Some of the terraces contain the highest producing timber soils in the area. Other Terrace Lands have intermediate to moderately high productivity for timber and herbaceous vegetation.

Management - Evaluation

GLACIAL OUTWASH LAND
Map Symbol 103

Location - Area north of Knox along the South Fork of the Salmon River

Management Zone - Mostly travel and water influence

Extent - Acres: 4,520
Percent of Area: 1.9

Topography - Slope Gradient: 0 - 10%
Aspect: All
Elevation: 5,500 - 7,000'

Geomorphic Features - Glacial Outwash Land designates the smooth flat landscape in the Warm Lake Basin and terrace-like lands adjacent to the South Fork of the Salmon River north of the Warm Lake Highway. These lands are similar to Moraine Land Undifferentiated. The chief distinction between them is that materials in the Outwash Lands are stratified while the materials in the Moraines are well mixed. Also Glacial Outwash Land has a smooth micro-relief as compared to the hummocky micro-relief of the Undifferentiated Moraine Land.

Bedrock-Characteristics - Depth to bedrock is 10 feet or more.

Vegetation- The vegetation consists of moderate to dense stands of lodgepole pine over elk sedge and low huckleberry. Some areas have meadow vegetation. The ground cover density in this unit varies from 10 to 100 percent. The crown cover ranges from 20 to 30 percent for the overstory and 30 to 40 percent for the understory.

Soils - The dominant soils on this unit are 9 (40%), 8 (30%), 8b (30%). The 9 soil has bright colored sandy loam surfaces over sandy loam and loamy sand subsurfaces. The 8 soil has dark colored sandy loam surfaces over dark colored sandy loam and loamy sand subsurfaces. The 8b soil is similar to the 8 soil except it is stony throughout. All the soils are 60 inches or more deep.

Management - Qualities These lands provide some of the most favorable routes and materials for road building. There is a moderate surface erosion hazard on high cut slopes.

Many soils on this unit have such stony and coarse textured subsoils that a large majority of the tree roots are in the surface to 2 feet. Consequently, timber productivity potentials on many of these lands are low. Herbage productivity on some of the outwash land presently occupied by meadows is medium. Glacial Outwash Lands store little water but are excellent aquifers for sustaining stream from water produced by higher elevational land types.

Management - Evaluation

VALLEY TRAIN LAND
Map Symbol 104

Location - Rice Creek, Cabin Creek

Management Zone - Crest and some Travel or Water Influence

Extent - Acres: 6,646
Percent of Area: 2.7

Topography - Slope Gradient: 0 - 20%
Aspect: All
Elevation: 5500 - 7500'

Geomorphic Features - Valley Train Lands comprise the bottoms and lower side slopes of the U-shaped Glacial Troughs. It includes Alluvial Land, Glacial Outwash, Terrace Remnants, lateral and ground moraine remnants, small alluvial fans and colluvial toe slopes. The general land type name is used because many of the component landforms have either been severely altered or are of a very small extent. The glacial trough bottoms which contain Valley Trains are narrow and contain highly variable kinds of material. However, their dominant characteristics as well as their significant range in characteristics can be described and evaluated. These lands are within the Strongly Glaciated Land geomorphic group. They are described with a Depositional Land because of

their relative position in the landscape and their depositional characteristics.

Bedrock-Characteristics — The granitic bedrock is generally from 4 to 6 feet or more beneath the soil mantle and is slightly to moderately well fractured, hard and unweathered.

Vegetation- The dominant vegetation on these land types is subalpine fir, Engelmann spruce, and lodgepole pine. Ground cover consists of elk sedge, and low huckleberry. Ground cover densities range from 80 to 100 percent. The crown cover for the overstory ranges from 20 to 40 percent and 20 to 30 percent for the understory.

Soils - The dominant soils in this unit are 9b (40%), 9 (30%), lla (30%). The 9b soil has bright colored sandy loam surface horizons over sandy loam and loamy sand subsurface horizons. The 9 soil is similar except it has more than 35 percent by volume of angular coarse fragments in the profile. Eleven-a soil has loamy sand textures on the surface and the subsurface has more than 35 percent by volume of coarse fragments. The 9b and 9 soils occur on the more gentle slopes and the lla soil occurs on the steeper side slopes. The soils on this unit range from 24 to 48 inches to bedrock.

Management - Qualities — Hydrologically, the Valley Train Land offers an effective buffer from surrounding steep glacial trough lands and only a small percentage of run-off is delivered to the streams as surface run-off. The upper reaches of streams in these lands are extremely stony and resistant to damage from high run-off. The middle and lower reaches of the streams in these lands are apt to be less stony and more subject to damage by bank cutting and damage by peak flows. Problems of road building on these lands is mainly involved with highly variable materials, numerous wet spots and avalanche hazards from above and stream encroachment problems. Another problem in these lands has been having to haul materials to get adequate bearing strength for fills across depressions and wet spots. The inherent erosion hazard on soils in this land type are moderately low to moderate. These lands contain some relatively high productive lands for Engelmann spruce. In some narrow drainages spruce stands serve as an effective buffer for sediment produced from heavily grazed south-facing slopes. These lands are an important part of the big game summer range and they provide travel routes, cover, water and forage for big game.

Management-
Evaluation

ALLUVIAL FAN LAND
Map Symbol 105

Location - Area near Stolle Meadows

Management Zone - Travel and Water Influence

Extent - Acres: 1,043
Percent of Area: .4

Topography - Slope Gradient: 5 - 20%
Aspect: All
Elevation: 3500 - 4000'

Geomorphic - Features: Alluvial Fan Land is relatively uncommon on the District. This land type was mapped only where it could be delineated consistently at the limiting scale of the aerial photos used. Alluvial Fans are cone-shaped deposits of alluvium made by streams when they flow out onto a level plane or meet a slower stream.

Bedrock-Characteristics: The granitic bedrock is generally from 4 to 6 feet or more beneath the soil mantle and generally is slightly to moderately well fractured, hard and unweathered.

Vegetation - Timber species on these units are ponderosa pine and Douglas-fir. Understories are ceanothus, snowberry, willow, prunis and huckleberry and pine grass. Ground cover densities range in percent from 70 to 100.Crown cover densities for the overstory range from 20 to 30 percent and 30 to 50 percent for the understory.

Soils - The dominant soils on this unit are lla (40%), 1 (30%), and 7 (30%). The lla soil has loamy sand surfaces and subsurfaces. It is stony throughout the profile. The 1 soil has loamy sand surfaces and subsoils and are non-stony. The 7 soil has sandy loam surface horizons over sandy loam and loam subsurface horizons. Depth to bedrock for these soils is 6 feet or more.

Management - Qualities This land type, because of its favorable topography adjacent to main access routes, provides favorable administrative sites for campgrounds and recreation areas. These lands provide little hazard to road construction except for cut slopes which will have a moderately high erosion hazard on the steeper slopes. The inherent erosion hazard for this unit is moderately low. These lands have moderate to moderately high productivity potentials for timber and herbaceous vegetation.

Management - Evaluation

MORAINE LAND UNDIFFERENTIATED
Map Symbol 106

Location - Warm Lake Area

Management Zone - Intermediate, and some Travel or Water Influence

Extent - Acres: 2,610
Percent of Area: 1.1

Topography - Slope Gradient: 0 - 10%
Aspect: Dominantly North Elevation: 4500 - 6500'

Geomorphic Features - This land consists of ground moraine materials which have been reworked by running water and have had deposits of glacial outwash deposited on them. These lands are dominantly nearly level to gently sloping with low hummocky relief. Depressions are generally non-cobbly the first few feet in depth and the materials are generally non-stratified.

Bedrock-Characteristics - Depth to bedrock is usually 10 feet or more.

Vegetation - The vegetation consists of moderate to dense stands of lodgepole pine over elk sedge and low huckleberry. The ground. cover density in this unit varies from 70 to 100 percent. Crown cover ranges from 20 to 30 percent for the overstory and 30 to 40 percent for

the understory.

Soils - The dominant soils on this land type are 9b (50%), and 8b (50%). The 9b soil has a bright colored sandy loam surface over sandy loam and loamy sand subsurfaces. The 8b soil has dark colored surface horizons with sandy loam surface textures over sandy loam and loamy sand subsurface textures. Both the 9b and 8b soils are cobbly throughout the profile and on the surface. These soils are more than 6 feet to bedrock.

Management - Qualities These lands are among the most stable in the survey area in all respects and offer few problems in road construction except where it is necessary to make deep cuts in which case the back slopes tend to erode. The inherent erosion hazard for this unit would be moderately low. In most other respects these lands have about the same interpretations as River Terrace Lands. However, these lands, because they are at a higher elevation tend, to be somewhat less productive.

Management - Evaluation

LATERAL MORAINE LAND
Map Symbol 106a

Location - Warm Lake Area

Management Zone- Crest and. Intermediate

Extent - Acres: 1,298
Percent of Area: .5

Topography - Slope Gradient: 10 - 35%
Aspect: Dominantly Northerly Elevation: 6000 - 7500'

Geomorphic - Features: Lateral moraines are associated with the major alpine glaciated valleys. These lands were deposited above and on the lateral margins of the valley glaciers. Most of these lands have a total relief approaching 150 feet and slope gradients ranging dominantly from 10 to 35 percent. Where mapped on the side of glacial troughs, the slope gradients may be as high as 40 - 45 percent.

Bedrock - Characteristics: Depth to bedrock is generally 10 feet or more.

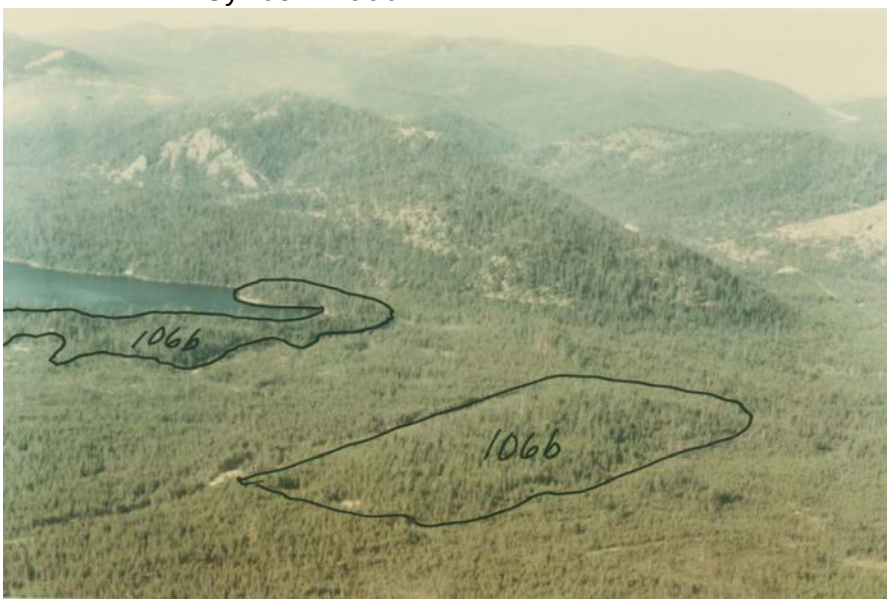
Vegetation - These lands produce dominantly lodgepole pine, sub-alpine fir and some Douglas-fir. They have understories of low huckleberry, elk sedge and pine grass. Ground cover densities range from 60 to 80 percent. The crown cover density ranges from 15 to 30 percent for the over-story and 15 to 20 percent for the understory.

Soils - The dominant soils on this land type are 9b (50%), and 8b (50%). The 9b soil has a bright colored sandy loam surface over sandy loam and loamy sand subsurfaces. The 8b soil has dark colored surface horizons with sandy loam surface textures over sandy loam and loamy sand subsurface textures. Both the 9b and 8b soils are cobbly throughout the profile and on the surface. These soils are more than 6 feet to bedrock.

Management Qualities - The inherent erosion hazard of the soils in this unit is moderate. The management qualities of this unit are similar to that of Moraine Land Undifferentiated (106), except that the surface erosion hazard for cut and fill slopes is somewhat higher because of the steeper topography.

Management Evaluation -

END MORAINE LAND Map
Symbol 106b



Location - Warm Lake Area

Management Zone - Crest and Intermediate

Extent - Acres: 941
Percent of Area: .4

Topography - Slope Gradient: 10 - 25%
Aspect: Dominantly Northerly
Elevation: 6000- 7500'

Geomorphic Features - End moraines are gently sloping lands which consist of highly mixed deposits of materials pushed up by the terminal ends of glaciers.

Bedrock-Characteristics - Deeper than 10 feet to bedrock.

Vegetation - The vegetation consists of moderate to dense stands of lodgepole pine over elk sedge and low huckleberry. The ground cover density in this unit varies from 70 to 100 percent. The crown cover ranges from 20 to 30 percent for the understory.

Soils - The dominant soils on this land type are 9b (50%), and 8b (50%). The 9b has a bright colored sandy loam surface over sandy loam and loamy sand subsurfaces. The 8b soil has dark colored surface horizons with sandy loam surface textures. Both the 9b and 8b soils are cobbly throughout the profile and on the surface. These soils are more than 6 feet deep to bedrock.

Management - Qualities These lands are among the most stable in the survey area in all respects and offer few problems in road construction except where it is necessary to make deep cuts in which case the back slopes tend to erode. The inherent erosion hazard for this unit is moderately low. In most other respects these lands have about the same interpretations as River Terrace Lands. However, these lands, because they are at a higher elevation tend to be somewhat less productive.

Management - Evaluation

APPENDIX A

LAND TYPE INTERPRETATIONS

AND

CRITERIA

Explanation of Table 9

LAND TYPE CHARACTERISTICS, HYDROLOGIC QUALITIES, EROSION AND STABILITY HAZARDS

General Characteristics and Hydrologic Qualities

(1) Dominant Slope Range and Aspect

Gives the dominant slope gradient range in percent for each land type. If a land type has a dominant aspect, it is also shown in this column.

(2) Ground Cover

Gives the dominant ground cover range in percent for each land type. Ground cover was considered to be basal cover plus litter older than one year. Rock outcrop is not included in these ground cover percentages. Ground cover percentages for rock outcrop can be considered zero percent.

(3) Crown Cover

This column gives the range in percent for the crown cover densities of the overstory and the understory. Understory as used here includes brush and shrubs.

(4) Bedrock Characteristics

The following key was used to describe the granitic bedrock characteristics.

Fracturing	Distance Between Fractures
1. Massive	6' or more
2. Slightly fractured	4 - 6'
3. Moderately fractured	1.5 - 4'
4. Well fractured	.5 - 1.5'
5. Extremely well fractured	.5' or less

Weathering

1. Hard unweathered
2. Moderately hard, somewhat weathered (non-spelling)
3. As above but spalling
4. Moderately soft-moderately weathered
   (fracturing often masked)
5. Soft-well weathered
   (roots often penetrate between fractures)

These fracturing and weathering classes were used for all the land types except for the Depositional Land Types. These lands are generally so deep to bedrock that the bedrock characteristics could not be examined.

(5) Soil Composition

This column gives the soil number and the estimated pcercentages of each soil which may be found in the land type. These soils have been classified to the soil family level according to the criteria in the Comprehensive Soil Classification System. Each soil family that has been identified on the District has been assigned a number which is listed in this column. The soil familes are identified and described in Table 17.

Surface Erosion Hazards

(6) Inherent Erosion Hazard. (natural surface)

Rated for bare soil conditions according to five qualitative classes. These classes are based on the ability of the soils to take in water, resistance of the soil surface to dispersion under the impact of rain fall and surface water movement, effect of coarse fragments that re-
duce surface detachment and effect of topography. Climate was considered a constant.

5 - High - Unprotected bare soil will erode sufficiently to severely and permanently damage the production capacity of the soil or will yield excessively high volumes of sediment. (assumes geologic significance)

4 - Mod. High - Unprotected bare soil will erode sufficiently to severely damage productive capacity or will yield high volumes of sediment.

3 - Moderate - Sufficiently resistant to erosion to permit limited and temporary exposure of bare soil. during development or use.

2 - Mod. Low - Sufficiently resistant to erosion to permit exposure of bare soil under minimal precautionary restrictions.

1 - Low - No appreciable hazard of erosion.

The following method was used to determine the above classes.

$$\text{Inherent Erosion Hazard Class} = \frac{\text{Soil Erodibility} + \text{Topographic Hazard}}{2}$$

Soil erodibility was taken as an average of soil erodibility adjusted for protective coarse fragments of the dominant soils in each land type. Five class values were used for soil erodibility and topographic hazard. They are:

Soil Erodibility Index

Permeability X Detachability each on a 0 - 10 Scale	Class Rating
0 - 5	1
6 - 20	2
21 - 40	3
41 - 7o	4
71 - 100	5

The topographic hazard estimate was based on slope gradient only. Slope class values to be added to soil erodibility are shown below.

Slope Classes

Slope Gradient	Class Rating
0 - 5	1
6-20	2
21 - 45	3
46 - 65	4
66+	5

(7) Surface Erosion Hazard. Cut and Fill Slopes

5 - Qualitative Classes. Rating according to the same characteristics as column number 6. Based on (a) cut ratios of 3/4: 1 on roads 24 feet wide on the dominant slope gradient for the land type and (b) uncompacted fills with ratios and heights inferred from 24 foot wide roads and dominant slope gradient with balanced cut and fill design, bare of vegetal cover, bermed and with an out-sloped bed. Classes are:

High - Unprotected cuts and fills will yield excessively high volumes of sediment.

Moderately High - Unprotected cuts and fills will yield excessively high volumes of sediment during periods of flashy or long duration runoff.

Moderate - Sufficiently resistant to erosion to permit temporary exposure of bare soil after construction.

Moderately Low - Sufficiently resistant to erosion to permit exposure of bare soil under minimal precautionary restrictions.

Low - No appreciable hazard erosion.

(8) Surface Erosion Hazard. Roadbeds

Five qualitative classes rated according to the same characteristics as column No. 6. Based on compacted roadbeds without wearing or base coarse on 6% grade sustained for 1,000 feet in length, without culverts, with minimum lateral sloping or crowning, and with tread ruts.

Classes are:

High - Road bed will yield excessively high amounts of sediment and will require constant repair to maintain trafficability.

Moderately High - Road bed will yield high amounts of sediment and will erode sufficiently to require repair for maintenance of trafficability.

Moderate - Sufficiently resistant to erosion to only require intermit-
tent seasonal repair for maintenance of trafficability.

Moderately Low - Sufficiently resistant to erosion to require only occasional repair for maintenance of trafficability.

Low - No appreciable hazard of erosion.

Mass Stability Hazards

(9) Debris Slides

This column gives relative hazards for the failure of accumulations of materials in (draws) confined drainages. It is based on the
estimated period of reoccurrences of estimated climatic conditions which cause such slides to occur. The classes are:

High - Frequency of occurrence is one slide every 15 years or less.

Moderately High - Frequency of occurrence is 15 to 25 years.

Moderate - Frequency of occurrence is 25 to 50 years.

Moderately Low - Frequency of occurrence is 50 to 100 years.

Low - Frequency of occurrence is more than 100 years.

(10) Slump

This column gives the relative hazard for lineal or bow-shaped failures of slopes to occur in any given year under natural conditions. The area as a whole has a relatively low hazard for these kinds of failures. Most of them will occur in seeps and low spots or at the toes of slopes. A few have occurred as a structural failure in weathered bedrock or slippage along joining planes in the bedrock.

5 - Qualitative classes were used. They are low, moderately low, moderate, moderately high, high. The moderately high and high classes are probably the only classes which would be a significant hazard to land management.

(11) Wet and Dry Creep

This column gives the relative rate classes of wet and dry creep. This is an extremely important interpretation because these processes are the main ways which materials are moved down slope and accumulated in draws. The materials thus accumulated in the draws are poised for those climatic and soil moisture conditions which will clean these draws of accumulation as a debris slide. Measurements of natural sediment production from all sources in Circle End and Tail Holt creeps average 25 cubic yards per square mile per year. The characteristics of these lands can be related to the long term movement of material downslope by the creep processes. Other lands can be compared to these lands on a relative basis and a relative 5 class interpretation made.

These classes are:

High
Moderately High
Moderate (Circle End and Tail Holt as base) Moderately Low
Low

(12) Cut Slope Stability Hazard

This column gives five hazard classes for mass failures of road cuts.The hazards are dependent essentially on the same factors as were natural slope stability. Generally speaking a road cut will be less stable than a natural slope. The chief variable is the height and angle of cut. Land types with the highest cut slope failure hazards generally have an accumulation of fine textured homogenous materials, steep slopes, and a subsurface moisture source. Five qualitative classes were used based on the relative volumes of materials which could be expected from mass failures of the cut slope. These classes are stated in terms of sediment production and maintenance problems.

Classes are:

High - Cut slopes will yield excessively high volumes of material from mass failures and the road will require constant removal of material to keep sediment from reaching streams and in some instances to maintain trafficability.

Moderately High - Cut slopes will yield high volumes of material from mass failures which will require almost constant removal of material from the road bed to keep sediment from reaching streams.

Moderate - Cut slopes will yield such volumes of materials from mass failures that the road will only require seasonal removal of material.

Moderately Low - Cut slopes will yield only such volumes of material that only occasional removal of material will be required.

Low -No appreciable hazard of mass failure of the cut slopes.

(13) Fill Slope Mass Stability Hazard

This column gives five qualitative classes for road fill failure. Criteria are much the same as those considered for evaluating the hazard of debris slides on natural slopes and a consideration of the strength of properties of the materials used in the construction of fills. The mass failures of fills is highest when the fill materials are poorly graded and subject to saturation at their base. These classes are based on the amount of sediment which would be caused by the mass failures and the amount of maintenance required to maintain trafficability. The classes are:

High - Mass failures of fill slopes will yield excessively high volume of sediment to the stream channels and the road bed will require frequent repair to maintain trafficability.

Moderately High - Fill slopes will yield high volumes of sediment to the stream channel and the road bed will require frequent repair to maintain trafficability.

Moderate - Mass failures of fill slopes will yield moderate amounts of sediment to the stream channel and the road bed will require only seasonal repair to maintain trafficability.

Moderately Low - Mass failures of fill slopes will yield very little volumes of sediment to the stream channel and the road bed will require only occasional repair for maintenance of trafficability.

Low - No appreciable hazard of failure.

(14) Avalanche Hazard

This column gives 5 classes of the degree of avalanche hazard based on distance between observed avalanche paths. On land types that were not rated, no avalanche paths were observed. Classes are:

High - 0 to 2000 feet

Moderately High - 2000 to 3000 feet
Moderate - 3000 to 4000 feet

Moderately Low - 5000 to 6000 feet
Low - 6000 to 8000 feet

Explanation of Table 10

HYDROLOGIC CHARACTERISTICS OF LAND TYPES

Average Annual Precipitation Range

This column gives the average annual precipitation range based on esoheytal analysis prepared by the United States Weather Bureau, River Forecasting Center using adjusted climatological data from 1930 - 57.

Percent Water Yield Range

This column gives the estimated range in water yield in percent of annual input for each land type. This estimate is based on an analysis of existing bulk density and moisture data and a consideration of vegetation, geology and drainage pattern, stoniness and depth of soils. These figures were checked, where possible, against existing stream flow measurements.

Percent of Surface Runoff Class

This column gives the estimate of percent runoff which can be expected from a one-and-one-half inch storm falling in one hour. Moist soil conditions are assumed.

TABLE 9
LAND TYPE CHARACTERISTICS, HYDROLOGIC QUALITIES, EROSION AND STABILITY HAZARDS

Map Symbol	Land Type	General Characteristics & Hydrologic Qualities							Surface Erosion Hazards				Mass Stability Hazards					Avalanche Hazard
		Dominant %Slope Range &Aspect	Ground Cover %	Crown Cover		Bedrock Characteristic		Soil Compo-sition No.%	Inherent Erosion Hazard	Roads			Natural Hazards			Roads		
				Over-Story	Under-Story	Fract-uring	Weath-ering			Cut Slope	Fill Slope	Road Surface 6% Grade	Debris Slides	Slump	Wet Dry Creep	Cut Slope Hazard	Fill Slope Hazard	
		(1)	(2)	(3)	(3)	(4)	(4)	(5)	(6)	(7)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
101	Alluvial Land	0-5	70-90	0-60	20-50	-	-	18-50										
								12-20 12a-30	Low	Low-Mod. Low	Low-Mod. Low	Low	Low	Low	Low	Low-Mod. Low	Low	-
102	Terrace Land	0-20	60-90	20-30	30-50	-	-	12-60	Mod.Low	Mod.	Mod.	Low-Mod. Low-	Low	Low	Low	Mod.	Mod.	-
								12a-20 5-20		Low	Low					Low	Low	
103	Glacial Outwash Land	0-10	70-100	20-30	30-40	-	-	9-40	Mod.Low	Mod.	Low	Low	Low	Low	Low	Mod.	Low	-
								8-30 8b-30		Low						Low		
104	Valley Train Land	0-20	80-100	20-40	20-30	-	-	9b-40	Mod.Low-	Mod.	Mod.	Mod.	Low	Low	Low	Mod.	Low	-
								9-30 11a-30	Mod.		Low					Low		
105	Alluvial Fan Land	5-20	60-80	15-25	20-30	-	-	11a-40	Mod.Low	Mod.	Mod.	Low	Low	Low	Low	Mod.	Mod.	-
								1-30		Low	Low					Low	Low	
106	Moraine Land Undifferentiated	0-10	70-100	20-30	30-40	-	-	9b-50		Low	Low	Low	Low	Low	Low	Mod.	Low	
								8b-50	Mod.Low							Low		
106a	Lateral Moraine Land	10-35	60-80	15-30	15-25	-	-	9b-50	Mod.	Mod.	Mod.	Mod.	Low	Low	Low	Mod.	Mod.	
								8b-50			Low						Low	
106b	End Moraine Land	10-25	60-80	25-35	30-40	-	-	9b-50	Mod.Low	Mod.	Mod.	Mod.Low	Low	Mod.	Low	Mod.	Mod.	
								8b-50		Low	Low			Low			Low	
107	Toe Slope Land	35-55	30-80	20-30	10-20	2	3-4	9b-40	Mod.Low-	Mod.	Mod.	Mod.	Mod.Low	Low-Mod	Mod.	Mod.	Mod.	
								1-40 5-20	Mod.		Mod. High		Mod.	High	Low-Mod. High	High	High	

TABLE 9

LAND TYPE CHARACTERISTICS, HYDROLOGIC QUALITIES, EROSION AND STABILITY HAZARDS (continued)

Map Symbol	Land Type	General Characteristics & Hydrologic Qualities							Surface Erosion Hazards				Mass Stability Hazards					Avalanche Hazard
		Dominant %Slope Range &Aspect	Ground Cover %	Natural Hazards		Natural Hazards		Soil Compo-	Inherent Erosion	Roads			Natural Hazards			Roads		
				Over-Story	Under-Story	Fract-uring	Weath-ering	sition No.%	Hazard	Cut Slope	Fill Slope	Road Surface	Debris Slides	Slump	Wet Dry Creep	Cut Slope Hazard	Fill Slope Hazard	
		(1)	(2)	(3)	(3)	(4)	(4)	(5)	(6)	(7)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
108	Glacial Plastered Mountain Slope Land	35-45 N.,E.	60-90	25-35	20-30	3	4-5	9b-40 lla-25 15-25	Mod. Low-Mod	Mod.	Mod, Mod. High	Mod.Low-Mod.	Low-Mod. Low	Low-Mod. Low	Mod. Low Mod.	Mod.	Mod.	
109	Weakly Glaciated Upland	25-45	50-80	5-30	0-20	2-3	4	9b-40 8b-20 9d-20	Mod. Low-Mod.	Mod.-Mod. High	Mod.-High	Mod.Low-Mod.	Low	Low-Mod.	Low-Mod. Low	Mod. Low Mod	Mod.	
109a	Thin Mangled Weakly Glaciated Upland	25-40	10-30	5-20	0-10	2	3	10-50 11-30 9c-20	Mod.-Mod. High	Mod.	Mod.-High	Mod.-High	Low-Mod Low	Low	Mod.-Mod. High	Low	Mod.	-
109b	Moderately Dissected Weakly Glaciated Land	35-50 N.-E	20-60	10-30	10-20	2-3	3-4	9b-50 8b-20 11a-30	Mod.	Mod.-Mod. High	Mod.-High	Mod. Low-Mod.	Low	Mod. Low-Mod.	Low-Mod. Low	Mod.	Mod.	
110	Cirque Basin Land	10-30 N.	30-60	10-20	5-10	2-3	1	lla-30 9b-30 8b-20 9c-20	Mod. Low-Mod.	Mod. Low-Mod.	Mod. Low-Mod.	Mod. Low	Low	Low	Low	Low-Mod. Low	Low	
110x	Scoured Cirque Basin Land	20-35 N.	20-40	5-15	0-10	2-3	1	10a-60 lla-20 RO-20	Mod.	Mod.	Mod. Low-Mod.	Mod.Low	Low	Low	Low	Low	Low	Mod.High
111a	Weakly Dissected Glacial Trough Land	40-55 N.,E.	30-70	10-25	5-20	3-4	1-2	1la-40 8a-35 9-25	Mod.	Mod.	Mod.-Mod. High	Mod.Low	Low	Mod. Low	Mod. Low	Mod.	Mod. Low	Mod.Low-Mod.
1llb	Moderately Dissected Glacial Trough Land	45-60	30-60	10-15	5-15	3-4	1-2	lla-30 9-30 10a-20 9b-20	Mod.	Mod. Low	Mod.-Mod High	Mod. Low	Mod. Low	Mod. Low	Mod. Low	Mod.	Mod. Low	Mod-Mod. High

TABLE 9

LAND TYPE CHARACTERISTICS, HYDROLOGIC QUALITIES, EROSION AND STABILITY HAZARDS (continued)

Map Symbol	Land Type	General Characteristics & Hydrologic							Surface Erosion Hazards				Mass Stability Hazards					Avalanche Hazard
		Dominant %Slope Range &Aspect	Ground Cover %	Crown Cover		Bedrock Characteristic		Soil Compo-sition No.%	Inherent Erosion Hazard	Roads			Natural Hazards			Roads		
				Over-Story	Under-Story	Fract-uring	Weath-ering			Cut Slope	Fill Slope	Road Surface	Debris Slides	Slump	Wet Dry Creep	Cut Slope Hazard	Fill Slope Hazard	
		(1)	(2)	(3)	(3)	(4)	(4)	(5)	(6)	(7)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
ll1c	Strongly Dissected Glacial Trough Land	60-75	20-50	0-10	20-40	3-4	1-2	10a-50 10-30 11a-15 RO-15	Mod. High	Mod. Low	Mod.	Mod. low	Mod. High	Mod. Low	Mod. Low	Mod.	Mod. Low	High
111d	Steep Rocky Cirque Headland	60-75	15-40	0-5	5-15	3	1-2	10-50 10a-30 RO-20	High	Mod.	Mod- Mod High	Mod. Low	Mod. High	Mod. Low	Mod. Low	Mod. Low- Mod.	Mod. Low	High
112	River Spur Land	45-60	20-70	5-25	5-20	3	2-5	3-30 16a-30 1-40	Mod. High	Mod. High-	Mod High-	Mod.	Mod.- Mod. High	Mod. Low	Mod- Mod. Low	Mod.	Mod. High	
113	Rocky Ridge land	65-80	5-20	0-5	5-10	3,4	1-2	10a-35 1la-15 RO-50	High	Mod.	Mod.	Mod. Low	Mod. Low	Low	Low	Low	Mod. Low	High
114	Subalpine Rim Land	40-55 S,W	15-50	0-15	0-5	3-5	1-2	8b-40 8a-30 lla-30	Mod. Low- Mod.	Mod.- Mod. High	Mod.	Mod. Low	Low	Low	Mod. Low- Mod.	Mod. Low- Mod.	Mod. Low	Mod-Mod. High
115	Glacial Scoured Mountain Slope Land	40-60	15-40	5-15	5-10	3	1-2	10a-70 1la-20 RO-10	Mod. High	Mod. Low	Mod. Low	Mod. Low	Low	Low	Low	Mod. Low	Mod. Low	Mod. High
120a	Weakly Dissected Mountain Slope Land	40-55	60-90	15-35	15-30	3	2-4	17-30 1-35 15-20 9-15	Mod.	Mod- Mod. High	Mod- Mod. High	Mod. Low Mod.	Mod. Low	Mod. Low	Mod.	Mod.	Mod- Mod. High	Low-Mod.
120b	Moderately Dissected Mountain Slope Land	45-60 N.,E.	50-80	15-35	15-30	3	2-4	2-40 3-30 7-15 17-15	Mod- Mod. High	Mod- Mod. High	Mod- High	Mod. High	Mod.	Mod. Low	Mod. Low- Mod.	Mod. Low	Mod- Mod. High	Low-Mod

TABLE 9

LAND TYPE CHARACTERISTICS, HYDROLOGIC QUALITIES, EROSION AND STABILITY HAZARDS (continued)

Map Symbol	Land Type	General Characteristics & Hydrologic Qualities							Surface Erosion Hazards				Mass Stability Hazards					Avalanche Hazard
		Dominant %Slope Range	Ground Cover %	Crown Cover		Bedrock Characterist		Soil Composition No.%	Inherent Erosion Hazard	Roads			Natural Hazards			Roads		
				Over-Story	Under-Story	Fracturing	Weathering			Cut Slope	Fill Slope	Road Surface	Debris Slides	Slump	Wet Dry Creep	Cut Slope Hazard	Fill Slope Hazard	
		(1)	(2)	(3)	(3)	(4)	(4)	(5)	(6)	(7)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
120b-1	Moderately Dissected Thin Mantled Mountain Slope Land	40-55 S.,W	25-45	5-25	10-20	3	3-5	3-30 1-30 15-20 4-20	Mod. High-High	Mod-Mod. High	Mod. High-High	Mod. High	Mod-Mod. High	Mod. Low	Mod. Low-Mod. High	Mod. low	Mod. Low	
120c	Strongly Dissected Mountain Slope Land	50-65 S., W.	15-40	10-25	10-20	2-3	3-5	3-30 1-50 4-20	Mod. High-High	Mod-High	Mod. High-High	Mod. High	Mod-High	Mod. Low	Mod. High-High	Mod.	Mod. High	Mod-Mod. High
120c-1	Strongly Dissected Thick Mangled Mountain Slope Land	50-70 N., E.	50-70	15-30	15-30	2-3	3-4	3-30 1-40 15-20	Mod-High	Mod-Mod. High	Mod. High-High	Mod-Mod. High	Mod-High	Mod. Low	Mod-Mod. High	Mod.	Mod. High-High	Mod-Mod. High
120d	Steep Rocky Head Land	65-75	10-30	5-15	5-20	2-3	2-3	16-50 1-20 RO-30	High	High	High	Mod-Mod. High	Mod-High	Mod. Low-Mod.	Mod. High-High	Mod.	High	Mod-Mod. High
120e	Maturely Dissected Mountain Slope Land	30-45	40-70	15-35	10-25	2-3	4-5	1-30 3-20 14-20 4-30	Mod.	Mod-Mod. High	Mod-High	Mod. Low-Mod. High	Mod. Low-Mod High	Mod. Low	Mod-Mod. High	Mod-	Mod-	
120e-1	Steen Maturely Dissected Mountain Slope Land	35-55	35-55	15-25	10-20	2-3	3-5	1-40 4-30 3-30	Mod.	Mod. High	Mod. High	Mod.	Mod-Mod. High	Mod. Low	Mod. High	Mod.	Mod.	
121	Structural Basin Land	20-40	70-90	15-35	10-30	2-3	3-4	1-40 15-30 14-20	Mod.	Mod.	Mod.	Mod. Low - Mod. High	Mod. Low-Mod. High	Mod.	Mod.	Mod.	Mod.	

TABLE 9

LAND TYPE CHARACTERISTICS, HYDROLOGIC QUALITIES, EROSION AND STABILITY HAZARDS (continued)

Map Symbol	Land Type	General Characteristics & Hydrologic Qualities							Surface Erosion Hazards				Mass Stability Hazards					Avalanche
		Dominant %Slope Range &Aspect	Ground Cover %	Crown Cover		Bedrock Characterist		Soil Compo-sition No.%	Inherent Erosion Hazard	Roads			Natural Hazards			Roads		
				Over-Story	Under-Story	Fract-uring	Weath-ering			Cut Slope	Fill Slope	Road Surface 6% Grade	Debris Slides	Slump	Wet Dry Creep	Cut Slope Hazard	Fill Slope Hazard	
		(1)	(2)	(3)	(3)	(4)	(4)	(5)	(6)	(7)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
121e	Maturely Dissected	35-55	30-70	10-25	5-25	2-3	3-5	3-25 1-35 15-20	Mod- Mod. High	Mod.	Mod. High	Mod.- Mod. High	Mod.- Mod. High	Mod.	Mod.- Mod. High	Mod.	Mod.	
122	Oversteepened Canyon Land	65-75	15-70	5-15	0-40	2-4	2-4	3-30 16-30 1-30 RO-10	Mod. High- High	Mod. High	High	Mod.	Mod. High- High	Mod.- Mod. High	High	Mod.	High	
123	Faulted Bench Land	30-50	50-80	15-35	15-30	2-3	3-5	1-30 9-25 15-25 14-20	Mod.	Mod- Mod High	Mod. High- High	Mod-Mod High	Mod. Low	Mod.	Mod.- Low Low	Mod.	Mod- Mod. High	

TABLE 10

HYDROLOGIC CHARACTERISTICS OF LAND TYPES

Land Type Map Symbol	Average Annual Precip. Range	% Water Yield Range	% Surface R.O. Class
101	30-45	<25	0
102	25-30	<25	<10
103	20-40	<25	<15
104	25-50	<25	<10
105	20-45	<25	<10
106	30-45	<25	<15
106a	30-40	<25	<15
106b	35-45	<25	<15
107	35-50	<25	<10
108	20-50	20-30	<15
109	25-50	25-50	<15
109a	25-50	50-75	20-45
109b	30-50	30-60	<15
110	30-50	<30	<15
110x	35-50	50-70	10-40
111a	20-50	20-40	<20
111b	20-50	25-50	10-30
111c	30-50	50-70	20-50
111d	35-50	50-80	30-60
112	20-30	20-50	10-25
113	30-50	60-85	<40
114	30-50	40-60	10-40
115	35-45	50-80	10-45
120a	25-50	20-40	<15
120b	20-50	20-50	<20
120b-1	20-50	30-50	10-25
120c	20-45	25-65	15-40
120c-1	30-50	25-65	10-40
120d	30-45	30-65	25-50
120e	30-50	10-50	10-35
120e-1	35-45	20-60	10-35
121	30-40	10-25	<20
121e	35-40	15-40	<20
122	20-40	30-50	<40
123	30-45		

APPENDIX B

SOIL INTERPRETATIONS AND CRITERIA

Explanation of Table 11

SOIL HYDROLOGIC INTERPRETATIONS

Soil No.

This column gives the number assigned to each soil family. These soil families are described in Table 17.

Soil

This column gives the classification name of the soil taxonomic unit to the soil family level according to criteria established by the comprehensive soil classification system.

Depth to Bedrock

This column gives the range in inches to bedrock. Infiltration

Infiltration is the rate at which water enters the soil. The infiltration rate of a soil is controlled by the structure, porosity and texture of the surface layers. Five qualitative classes are used and they have the following quantitative ranges expressed in inches of water per hour.

Class	Rate (Inches/hr.)
Rapid	7.50 - 10.00
Moderately Rapid	5.00 - 7.50
Moderate	2.50 - 5.00
Moderately Slow	0.80 - 2.50
Slow	0.20 - 0.80

Permeability

Permeability is the rate at which water moves through the soil. The permeability of a soil is determined by structure and texture of the soil profile below the surface layers. The same five classes are used for permeability as were used for infiltration.

Detention Capacity

This column gives the water detention capacity of the soil expressed in

inches of water per foot of soil. Detention capacity (gravitational water) as used in this table represents the excess water subject to drainage that is held in the soil for short periods of time following complete saturation. This water is unavailable to plants and is generally only of interest to hydrologists. The numbers in this column represent net figures. Available and hydroscopic (unavailable) water have been subtracted. The water detention capacities were calculated from laboratory analysis figures for some of the soils and these figures were used on a comparative basis to calculate the detention capacities for the remaining soils.

Retention Capacity

This column gives the water retention capacity of the soil expressed in inches of water per foot of soil. Retention capacity (available water) as used here represents the water which may be taken up from the soil by a plant. The figures in this column are also net figures. Gravitational and hydroscopic water have been subtracted. The retention capacity figures were calculated in the same manner as were the detention figures in the previous column. The amount of water which a soil can hold depends primarily upon its texture. The texture may be significantly modified by the organic matter content of the soil. The moisture holding properties of the soil increase with an increasing content of silt, clay, and organic matter. In soils, water is held in pore spaces. Forces holding the water are primarily those of surface tension or surface attraction. Larger pore spaces will not hold water very tightly and hence most all water is pulled down by gravity and carried away as deep soil drainage. This represents the detention capacity or gravitational water in a soil. These figures were given in the previous column. Smaller pore spaces sometimes spoken of as capillaries, hold the water much more tightly and little is lost to deep drainage. This water, however, may be evaporated or taken up by plants.

Bedrock Characterization

This column gives three qualitative classes for penetration of the bedrock by moisture. There are no quantitative figures available and little is actually known concerning the degree and rate of penetration of the bedrock by moisture. These classes are purely relative and are based on characteristics of the bedrock such as fracturing and weathering. The three classes are as follows:

High - The bedrock is well to extremely well fractured and/or moderately soft, moderately weathered. to soft well weathered or a combination of both.

Moderate - The bedrock is moderately fractured, moderately hard and somewhat weathered.

Low - The bedrock is massive, hard and unweathered.

The definitions for the degrees of fracturing and weathering are the same as found under bedrock characteristics, Table 13,Appendix A.

Hydrologic Groups

Hydrologic soil groups are used for estimating the run-off potential of soils on watersheds. Four groups are used, based on soil properties that influence run-off. Classification is at the end of long duration storms occurring after prior wetting and an opportunity for swelling and without the protective effect of vegetation.

CRITERIA

Group A.

Soils having high infiltration rates, even when thoroughly wetted consisting chiefly of deep, well to excessively drained sands and/or gravel. These soils have a high rate of water transmission and would result in a low run-off potential.

Group B

Soils having moderate infiltration rates when thoroughly wetted, consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately coarse textures. These soils have a moderate rate of water transmission.

Group C

Soils having slow infiltration rates when thoroughly wetted consisting chiefly of (1) soils with a layer that impedes the downward movement of water of (2) soils with moderately fine to fine textures and a slow infiltration rate. These soils have a slow rate of water transmission.

Group D

Soils having very slow infiltration rates when thoroughly wetted, consist chiefly of (1) clay soils with a high swelling potential; (2) soils with a high permanent water table; (3) soils with clay pan or clay layer at or near the surface; and (4) shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission.

Soils Erodibility

Soils erodibility is a rating of the relative ease with which a soil surface is eroded. It is based on soil aggregate detachability and profile characteristics effecting the disposition of infiltered water. Coarse materials on the soil surface reduce the soil erodibility but vegetation, climate, and topography are not included in this estimate.

The soil erodibility index is the product of the permeability index and the detachability index, reduced by the percent of the surface covered by coarse fraction over three quarters of one inch in diameter. Both indices are on a zero to ten scale. The following classes are used:

Class	Index
Low	0 - 6
Moderately Low	7 - 20
Moderate	21 - 40
Moderately High	4l - 70
High	71 - 100

Explanation of Table 12

SOIL VEGETATIVE RELATIONSHIPS AND PRODUCTIVITY POTENTIALS

Soil Number

This column is the number assigned to each soil family. These soil families are described in Table 12, Appendix B.

Soil

This column gives the classification name of the soil taxonomic unit to the soil family level according to criteria established by the Comprehensive Soil Classification System.

Dominant Vegetation

This column gives a brief listing of the characteristic dominant vegetation associated with each soil.

Landform

This column gives the land types on which the soils occur. Timber

Productivity

These columns give the average estimated relative productivity for adapted tree species for each of the soil taxonomic units on the Cascade Ranger District. Five qualitative classes plus a non-commercial class are given for ponderosa pine and Douglas-fir with a site index range given for each class. The basis for these classes was the comparison of a limited number of height-age measurements with regional site curves and additional height-age measurements taken on similar soils on nearby districts. The classes are as follows:

Ponderosa Pine		Douglas-fir	
Class	Site Index Range	Class	Site Index Range
NC		NC	
Low	30-50	Low	30-50
Mod Low	50-70	Mod Low	50-60
Mod	70-90	Mod	60-70
Mod High	90-110	Mod High	70-80
High	110-130+	High	80-90+

Explanation of Table 13

SOIL PROFILE CHARACTERISTICS

Soil Number

This column gives the number assigned to each soil family.

Soil Family

This column gives the classification name of the soil taxonomic unit to the soil family level according to criteria established by the comprehensive soil classification system.

Depth to Profile

This column gives the average depth of the soil profile in inches.

Surface Layers

This column gives the textures, thickness, moist color and reaction the surface layers for each of the soils.

Subsoil Layers

This column gives the texture, thickness, moist color and reaction of the subsoil layers for each of the soils.

Bedrock Characteristics

This column describes the characteristics of the bedrock which are normally associated with the soils on the district. The definition for these terms may be found under bedrock characteristics in the explanation of Table 13, Appendix A.

Explanation of Table 14

SOIL CLASSIFICATION

This table gives the classification of the soils on the District at each of the various levels in the comprehensive classification system down to the soil family.

TABLE 11
SOIL HYDROLOGIC INTERPRETATIONS

Soil No.	Soil	Depth to Bedrock	Infiltrat-ion	Permeability	Detention Capacity	Retention Capacity	Bedrock Penetration	Hydro-logic Group	Soil Erodibility
1	Alfic Cryopsamments, mixed	40-60"	Rapid	Rapid	6.4	1.	Mod.	A	Mod.Low
2	Typic Cryoborolls, sandy, mixed	40-60"	Rapid	Rapid	6.4	1.	Mod.	A	Mod.Low
3	Lithic Hapludolls, sandy, mixed, frigid	10-20"	Rapid	Rapid	6.5	.9	Low-Mod.	D	High
4	Typic Cryoborolls, sandy, mixed,	10-20"	Rapid	Rapid	6.2	1.1	High	B	Moderate
5,6	Argic Cryoborolls, coarse Loamy, mixed	40-70"	Mod.Rapid	Mod.	3.7	2.0	High	B	Moderate
7	Typic Cryoborolls, coarse loamy, mixed	40-60"	Mod.Rapid	Mod.	3.9	1.8	Mod.	A	Moderate
7a	Typic Cryoborolls, loamy skeletal,	40-80"	Mod.Rapid	Mod.Rapid	2.5	1.1	Mod.	A	Mod.Low
8	Typic Cryumbrepts, coarse loamy, mixed	30-40"	Rapid	Mod.Rapid	4.0	1.7	Mod.	A	Mod.Low
8a	Typic Cryumbrepts, sandy skeletal,	30-48"	Rapid	Rapid	2.6	.7	High	A	Mod.Low
8b	Typic Cryumbrepts, loamy skeletal,	30-50"	Rapid	Mod.Rapid	2.5	1.1	Mod.	A	Mod.Low
9	Typic Cryochrepts, coarse loamy, mixed	30-50"	Mod,Rapid	Mod.Rapid	3.9	1.8	High	A	Moderate
9b	Typic Cryochrepts, loamy skeletal,	40-80"	Mod.Rapid	Mod.Rapid	2.5	1.2	High	A	Moderate
9c	Lithic Cryochrepts, coarse loamy, mixed	10-20"	Mod.Rapid	Mod.Rapid	2.5	1.2	Mod.	D	Mod.High
9d	Typic Cryochrepts, loamy, mixed,	16-20"	Mod.Rapid	Mod.Rapid	2.5	1.2	High	B	Moderate
10	Lithic Cryumbrepts, sandy, mixed	10-20"	Rapid	Rapid	6.7	.7	Low	D	High
10a	Lithic Cryumbrepts, sandy	10-20"	Rapid	Rapid	4.4	.5	Mod.	D	Mod.High
10b	Lithic Cryumbrepts, loamy	10-20"	Rapid	Rapid	2.5	1.1	Mod.	D	Mod.High
11	Typic Cryopsamments, mixed	30-50"	Rapid	Rapid	6.7	.7	Mod.	A	Low
lla	Typic Cryorthents, sandy skeletal mixed	24-36"	Rapid	Rapid	4.4	.5	High	A	Low
12	Entic Ultic Haploxerolls, sandy, mixed mesic	50-60"	Rapid	Rapid	6.4	1.0	Low	A	Mod.Low
12a	Entic Ultic Haploxerolls, sandy skeletal, mesic	80"+	Rapid	Rapid	4.2	.7	Mod.	A	Low
13	Typic Cryoboroalfs, coarse loamy, mixed	36-48"	Mod.Rapid	Mod,Rapid	3.5	2.1	High	B	Moderate
14	Typic Hapludolls, coarse loamy, mixed	40-50"	Mod.Rapid	Mod.	3.9	1.8	High	B	Moderate
15	Dystric Cryochrepts, coarse loamy,	40-60"	Mod.Rapid	Mod.Rapid	3.9	1.8	Mod.	A	Mod.Low
16	Lithic Xeropsamments, mixed, frigid	10-20"	Rapid	Rapid	6.5	.9	Mod.Low	D	High
17	Entic Cryumbrepts, sandy, mixed	40-80"	Rapid	High	6.4	1.0	High	A	Low
18	Typic Cryochrepts, coarse loamy over sandy skeletal, mixed.	80"+	Mod.Rapid	High	2.6	.7	High	A	Low

TABLE 12
SOIL VEGETATIVE RELATIONSHIPS AND PRODUCTIVITY POTENTIALS

Soil No.	Soil	Dominant Vegetation	Landform	Timber Productivity PP	DF
1	Alfic Cryopsamments, mixed	Douglas-fir, ponderosa pine, spires, tall huckleberry, ninebark, elk sedge, pine grass	Warm mid-elevational steep dissected mountain slopes	Mod-Mod High	Mod Low-Mod
2	Typic Cryoborolls, sandy, mixed	Douglas-fir, ponderosa pine, spires, tall huckleberry, elk sedge, pine gross	Same as above only some what cooler slopes	Mod-Mod High	Mod Low-Mod
3	Lithic Hapludolls, sandy, mixed frigid	Ponderosa pine,Douglas-fir, pine grass	Warm,steep dissected mountain slopes	Mod Low-Mod High	Mod Low
4	Typic Cryoborolls, sandy, mixed, shallow	Ponderosa pine, Douglas-fir, spires, tall Huckleberry, elk sedge, pine grass	Medium and low elevational dissected mountain slopes	Mod-Mod High	Mod Low-Mod High
5,6	Argic Cryoborolls, coarse loamy, mixed	Douglas-fir, ponderosa pine, spires, tall Huckleberry, elk sedge, pine grass	Cool, low elevational dissected mountain slopes, toe slopes, terrace land	Mod High-High	Mod-Mod High
7	Typic Cryoborolls, coarse loamy, mixed	Douglas-fir, ponderosa pine,spires, tall Huckleberry, elk sedge, pine grass	Cool, low elevational dissected mountain slopes, toe slopes, terrace land	Mod High-High	Mod-Mod High
7a	Typic Cryoborolls, loamy skeletel, mixed	Subalpine fir, lodgepole pine, Douglas-fir, elk sedge, low huckleberry	Dominantly moraine lands	NC	Low
8	Typic Cryumbrepts, coarse loamy, mixed	Open park-like stands of subalpine fir, tall forbs, big sage, elk sedge	Mostly on upper elevational south facing glacial troughs subalpine rim land	NC	Low
8a	Typic Cryumbrepts, sandy skeletal, mixed				
8b	Typic Cryumbrepts, loamy skeletal, mixed				
9	Typic Cryochrepts, coarse loamy, mixed	Lodgepole pine, subalpine fir, larch, spruce, Douglas-fir, low and tall huckleberry, wortleberry, sheperdia, elk sedge	Strongly and weakly glaciated lands, moraine lands	NC	Mod-Mod High
9b	Typic Cryochrepts, loamy skeletal,mixed				
9c	Lithic Cryochrepts, coarse loamy, mixed				
9d	Typic Cryochrepts, loamy mixed shallow	Douglas-fir, white fir, subalpine fir, lodgepole pine,larch, tall and low huckleberry, elk sedge	Cool mid-elevational dissected mountain slopes and weakly glaciated lands	NC	Mod High-High

TABLE 12
SOIL VEGETATIVE RELATIONSHIPS AND PRODUCTIVITY POTENTIALS

Soil No.	Soil	Dominant Vegetation	Landform	Timber Productivity	
				PP	DF
10	Lithic Cryumbrepts, sandy, mixed	Subalpine, lodgepole pine, Douglas-fir, whitebark pine, elk sedge, mosses, buckwheat ceanothis	Thin lands and high elevational mantled weakly glaciated lands and high elevational glaciated lands	NC	NC
10a	Lithic Cryumbrepts, sandy skeletal, mixed				
10b	Lithic Cryumbrepts, loamy skeletal, mixed				
11	Typic Cryopsamments, mixed	Subalpine-fir, Douglas fir, lodge pole pine, low and tall huckleberry, elk sedge	High elevational dissected mountain slopes weakly glaciated lands	NC	NC
11a	Typic Cryorthents, sandy skeletal, mixed				
12	Entic Ultic Haploxerolls, sandy, mixed mesic	Ponderosa pine, Douglas-fir prunis, willow, pine grass	Terrace land, toe slope land other low elevational depositional lands	Mod High	Low Mod
12a	Entic Ultic Haploxerolls, sandy skeletal, mesic				
13	Typic Cryoboralfs, coarse loamy, mixed	Douglas-fir, white fir, lodgepole pine	Weakly glaciated uplands, cirque basin, and moraine lands	NC	Mod-Mod High
14	Typic Hapludalfs, coarse loamy, mixed	Douglas-fir, ponderosa pine, white. fir, lodgepole pine, spires, snowberry, pine grass	Maturely dissected mountain slope land, faulted bench land	Mod-Mod High	Mod-Mod High
15	Dystric Cryochrepts, coarse loamy, mixed	Douglas-fir, ponderosa pine, larch, spirea, snowberry, pine grass, elk sedge	Lower elevational south facing glacial trough land and upper elevational mountain slope land	Mod-Mod High	Mod-Mod High
16	Lithic Xeropsamments, mixed, frigid	Ponderosa pine, pine grass bunch grass	Warm low elevational, steep dissected mountain slopes	Mod Low-Mod	Low
17	Entic Cryumbrepts, sandy, mixed	Douglas-fir, white fir, ponderosa pine, tall huckleberry, ninebark pine grass	Low and mid-elevational dissected mountain slopes	Mod	Mod-mod High
18	Typic Cryochrepts, coarse loamy over sandy skeletal, mixed	Lodgepole pine, grasses, sedges	High elevation depositional lands	NC	NC

TABLE 13

SOIL PROFILE CHARACTERISTICS

Soil No.	Soil Family	Depth of Profile	Surface Layers	Subsoil Layers	Bedrock Characteristics
1	Alfic Cryopsamments, mixed	40"-60"+	Coarse sandy loam to loamy coarse sand, one to 7 inches thick, brown to dark brown; slightly to medium acid.	Loamy sand to sand, 25 to 70 thick, light gray to yellowish brown; medium acid	Moderately hard, somewhat weathered to soft well weathered. Moderately fractured.
2	Typic Cryoborolls, sandy mixed	40"-6o"	Loamy sand or sandy loam, 10 to 16 inches thick, dark grayish brown to brown; slightly acid.	Loamy sand to fine gravelly loamy coarse sand, 24 to 50" thick, light gray to very pale brown; slightly to medium acid.	Moderately hard somewhat weathered, slightly to well fractured.
3	Lithic Hapludolls, sandy mixed frigid.	Less than 20"	Sandy loam or loamy sand, 5 to 16 thick, brown to grayish brown; slightly to medium acid.	Sandy loam or loamy sand, 2 to 10 inches thick, light gray to pale brown; slightly to medium acid.	Moderately hard, somewhat weathered, spalling, and slightly to moderately fractured.
4	Typic Cryoborolls, sandy mixed shallow	Less than 20"	Sandy loam to loamy sand, 4 to 12 inches thick, brown to dark grayish brown; slightly acid.	Loamy coarse sand to sandy loam, 4 to 12 inches thick, brown to very pale brown, slightly	Soft, well weathered, and Moderately to well fractured.
5,6	Argic Cryoborolls, coarse loamy mixed	40"-60"	Sandy loam to gravelly loam, 10 to 15 inches thick, brown to dark grayish brown, neutral to slightly acid.	Sandy loam to heavy loam, 10 to 35 inches thick, pale brown to light yellowish brown; slightly	Moderately hard, somewhat weathered to moderately soft, moderately weathered, and moderately fractured.
7	Typic Cryoborolls, coarse loamy mixed.	40"-60"	Sandy loam to loam, 8 to 10 inches thick, grayish brown to brown, slightly acid.	Loam to coarse sandy loam, 5 to 20 inches thick, slightly to strongly acid, over gray-elly loamy sands, sands,	Moderately hard, somewhat weathered, and moderately to well fractured.
7a	Typic Cryoborolls, loamy skeletal mixed,	40"-60"+	Sandy loam to loam, 8 to 10 inches thick, grayish brown to brown, slightly acid.	Loam to coarse sandy loam, 5 to 20 inches thick, slightly to strongly acid, over grav-elly loamy sands, sands or cobbly loamy sands. Has more than 35% by volume of cobble.	Moderately hard, somewhat weathered, and moderately to well fractured.

TABLE l3
SOIL PROFILE CHARACTERISTICS (cont'd)

Soil No.	Soil Family	Depth of Profile	Surface Layers	Subsoil Layers	Bedrock Characteristics
8	Typic Cryumbrepts, coarse loamy mixed	25"-45"	Loam or sandy loam, 10 to 15 inches, dark grayish brown to brown, medium to strongly acid.	Light loam or fine gravelly sandy loam, 7 to 30 inches thick, brown to yellowish brown, medium acid	Moderately hard,somewhat weathered, and well to extremely well fractured
8a	Typic Cryumbrepts, sandy skeletal mixed	25"-35"	Cobbly sandy loam to cobbly loamy sand, 10 to 15 inches thick, dark grayish brown to brown, medium to strongly acid.	Cobbly gravelly loamy sand,7 to 20 inches thick, brown to yellowish brown medium acid more than 35% by volume of angular	Moderately hard,somewhat weathered, and well to extremely well fractured
8b	Typic Cryumbrepts, loamy skeletal mixed	30"-50"	Loam or sandy loam, 10 to 15 inches, dark grayish brown to brown, medium to strongly acid.	Light loam or fine gravelly sandy loam, 7 to 30 inches thick, brown to yellowish brown, medium acid, has 35% or more by volume of subangular	Moderately hard,somewhat weathered, and well to extremely well fractured
9	Typic Cryochrepts, coarse loamy	30"-50"	Fine gravelly loam, 1 to 10 inches thick, grayish-brown to pale brown, medium to strongly acid	Sandy loam or fine gravelly loam, 7 to 40 inches thick, light gray to light yellowish brown, medium to strongly acid	Moderately soft, moderately weathered and well fractured.
9b	Typic Cryochrepts, loamy skeletal	40"-60"+	Cobbly fine gravelly loam, 1 to 10 inches thick, grayish-brown to pale brown, medium to strongly acid.	Sandy loam or fine gravelly loam,7 to 40 inches thick, light gray to light yellowish brown, medium to strongly acid loamy sands, 10 to 20"	Moderately soft, moderately weathered and well fractured.
9d	Typic Cryochrepts, loamy, mixed, shallow	Less than 20"	Fine sandy loam and gravelly sandy loam. 6 to 12 inches thick, brown to dark brown, medium acid.	Gravelly loamy sand, 8 to 10 inches thick. Yellowish brown, medium acid.	Soft, well weathered and moderately fractured.

TABLE 13
SOIL PROFILE CHARACTERISTICS (cont'd)

Soil No.	Soil Family	Depth Of Profile	Surface Layers	Subsoil Layers	Bedrock Characteristics
9c	Lithic Cryochrepts, coarse loamy mixed	Less than 20"	Fine gravelly loam, 1 to 10 inches thick, grayish-brown to pale brown medium to strongly acid.	Sandy loam or fine gravelly loam 6 to 14 inches thick, light gray to light yellowish brown, medium to strong acid.	Moderately soft, moderately weathered and well fractured.
10	Lithic Cryumbrepts, sandy mixed	Less than 20"	Loamy coarse sand, 4 to 8 inches thick, brown medium to strongly acid.	Gravelly sands, 2 to 10 inches thick, light gray or very pale brown, strongly to medium acid.	Moderately hard, somewhat weathered, spelling, and slightly fractured.
10a	Lithic Cryumbrepts, sandy skeletal mixed.	Less than 20"	Loam or sandy 10 to 15 inches, dark grayish brown to brown, medium to strongly acid, has more than 35% by volume of angular cobble.	Light loam or fine gravelly sandy loam 7 to 30 inches thick, brown to Yellowish brown, medium acid, has more than 35% by volume of angular cobble.	Moderately hard, somewhat weathered, and well fractured.
10b	Lithic Cryumbrepts, loamy skeletal mixed	Less than 20"	Sandy loam or loamy coarse sand, 4 to 8 inches thick, brown medium to strongly acid, has more than 35% by volume of angular cobble.	Gravelly and cobbly loam or sandy loam, light gray or very pale brown, strongly to medium acid, has more than 35% by volume of angular cobble.	Moderately hard,somewhat weathered, and well fractured.
11	Typic Cryopsamments mixed	30"-50"	Fine gravelly loam, sandy loam, loam 1 to 10 inches thick, grayish brown to pale brown, medium to strongly acid.	Sandy loam or fine gravelly loam 7 to 40 inches, light gray to light yellowish brown, medium to very strongly acid.	Moderately hard, somewhat weathered, and well fractured.
lla	Typic Cryorthents, sandy skeletal mixed.	30"-50"	Fine gravelly loam, sandy loam, loam, 1 to 10 inches thick, grayish brown to pale brown, medium to strongly acid, has more than 35% by volume of angular cobble	Sandy loam or fine gravelly 7 to 40 inches, light gray to light yellowish brown, medium to very strongly acid, has more than 35% by volume of cobble.	Moderately hard, somewhat weathered, and well fractured.
12	Entic Ultic Haploxerolls, sandy mixed mesic	40"-60"+	Loamy coarse sand to light sandy loam, 10 to 35 inches thick, light gray to brown,	Loamy sand, 15 to 40 inches thick light grayish brown to brown, slightly acid.	Moderately hard somewhat weathered and slightly fractured.

TABLE 3
SOIL PROFILE CHARACTERISTICS (cont'd)

Soil No.	Soil Family	Depth of Profile	Surface Layers	Subsoil Layers	Bedrock Characteristics
12a	Entic Ultic Haploxerolls, sandy skeletal, mixed mesic	80"+	Loamy coarse sand to light sandy loam, 10 to 35 inches thick, light gray to brown.	Loamy sand,15 to 40 inches thick,light grayish brown to brown, slightly acid, has more than 35% by volume sub-angular cobble.	Moderately hard somewhat weathered and slightly fractured
13	Typic Cryoboralfs, coarse loamy mixed	30"-40"+	Sandy loam,5 to 10 inches thick pale brown medium to strongly acid.	Sandy loam to sandy clay loam 10 to 30 inches thick, pale brown to brownish yellow, medium acid.	Soft well weathered and slightly fractured.
14	Typic Hapludalfs, coarse loamy mixed	40"+	Sandy loam to fine sandy loam, 3 to 10 inches thick, pale brown to grayish brown, medium acid.	Gravelly coarse sandy loam to sandy clay loam, 30 to 40, inches thick, very pale brown to light yellowish brown, medium	Soft well weathered and slightly to moderately fractured.
15	Dystric Cryochrepts, coarse loamy mixed	40"-60"+	Gravelly sandy loam, 6 to 12 inches thick,pale brown, medium acid.	Gravelly sandy loam, 20 to 40 inches thick, pale brown medium acid.	Moderately hard somewhat weathered, and well fractured.
16	Lithic Xeropsamments, mixed, frigid	Less than 20"	Sandy loam or loamy coarse sand 3 to 14 inches thick, pale brown, slightly acid.	Loamy coarse sand, 4 to 8 inches thick, light gray to brown	Moderately hard,somewhat weathered,spelling, slightly fractured.
17	Entic Crymbrepts, sandy, mixed	40"-80"	Loam or sandy loam, 10 to 15 inches thick, dark grayish brown to brown, slightly acid.	Loamy sand,18 to 40 inches thick, brown to light yellowish brown, slightly acid.	Soft, well weathered and moderately fractured.
18	Typic Cryochrepts, coarse loamy over sandy skeletal, mixed	80"+	Sandy loam or loam,6 to 12 inches thick,grayish brown to brown, medium acid.	Fine gravelly sandy loam to very gravelly loamy sand, 20 to 40 inches thick, strongly acid 35% by volume of subangular cobble.	Deep to bedrock, not examined.

TABLE 14
SOIL CLASSIFICATION
According to Comprehensive Classification System

Soil No.	Order	Suborder	Great Group	Subgroup	Family
lla	Entisols	Orthents	Cryorthents	Typic Cryorthents	Sandy skeletal, mixed
11	Entisols	Psamments	Cryopsamments	Typic Cryopsamments	Mixed
1	Entisols	Psamments	Cryopsamments	Alfic Cryopsamments	Mixed
16	Entisols	Psamments	Xeropsamments	Lithic Xeropsamments	Mixed, frigid
9	Enceptisols	Ochrepts	Cryochrepts	Typic Cryochrepts	Coarse loamy, mixed
9b	Enceptisols	Ochrepts	Cryochrepts	Typic Cryochrepts	Loamy skeletal, mixed
9d	Enceptisols	Ochrepts	Cryochrepts	Typic Cryochrepts	Loamy, mixed, shallow
18	Enceptisols	Ochrepts	Cryochrepts	Typic Cryochrepts	Coarse loamy over sandy skeletal, mixed
9c	Enceptisols	Ochrepts	Cryochrepts	Lithic Cryochrepts	Coarse loamy, mixed
15	Enceptisols	Ochrepts	Cryochrepts	Dystric Cryochrepts	Coarse loamy, mixed
8	Enceptisols	Umbrepts	Cryumbrepts	Typic Cryumbrepts	Coarse loamy, mixed
8a	Enceptisols	Umbrepts	Cryumbrepts	Typic Cryumbrepts	Sandy skeletal, mixed
8b	Enceptisols	Umbrepts	Cryumbrepts	Typic Cryumbrepts	Loamy skeletal, mixed
17	Enceptisols	Umbrepts	Cryumbrepts	Typic Cryumbrepts	Sandy, mixed
10	Enceptisols	Umbrepts	Cryumbrepts	Lithic Cryumbrepts	Sandy, mixed
10a	Enceptisols	Umprepts	Cryumbrepts	Lithic Cryumbrepts	Sandy, skeletal
10b	Enceptisols	Umprepts	Cryumbrepts	Lithic Cryumbrepts	Loamy, skeletal
2	Mollisols	Borolls	Cryoborolls	Typic Cryoborolls	Sandy, mixed
7	Mollisols	Borolls	Cryoborolls	Typic Cryoborolls	Coarse loamy, mixed
7a	Mollisols	Borolls	Cryoborolls	Typic Cryoborolls	Loamy skeletal, mixed
4	Mollisols	Borolls	Cryoborolls	Typic Cryoborolls	Sandy,mixed, shallow
5,6	Mollisols	Borolls	Cryoborolls	Argic Cryoborolls	Coarse loamy, mixed
3	Mollisols	Udolls	Hapludolls	Lithic Hapludolls	Sandy, mixed, frigid
12	Mollisols	Xerolls	Haploxerolls	Entic Ultic Haploxerolls	Sandy mixed, frigid
12a	Mollisols	Xerolls	Haploxerolls	Entic Ultic Haploxerolls	Sandy, skeletal, mixed mesic
13	Alfisols	Boralfs	Cryoboralfs	Typic Cryoboralfs	Coarse loamy, mixed
14	Alfisols	Udalfs	Hapludolfs	Typic Hapludolfs	Coarse loamy, mixed

All subsequent pages are probably not from this book but were included for scanning.

TABLE 14

SOIL HYDROLOGIC CHARACTERISTICS

Soil No.	Landtypes	Depth to Bedrock	Detention in./ft.	Retention in./ft.	Infiltration	Permeability	Bedrock Penetration	Hydro-logic Group	Ground Cover	
									Vegetation & Litter %	Rock & Pavement
la-1	109-2	30-50	7.4	2.8	Mod. Rapid	Mod. Rapid.	Moderate	A	50-80	0-10
1a-3	109-2	10-20	7.3	1.1	Mod. Rapid	Mod. Rapid	High	B	50-70	0-10
lf-5	111b-1	20-40	0.9	0.8	Mod. Rapid	Mod. Rapid	Mod.-High	A	60-70	10-15
lg-3	111b-1, 113	Less	2.2	1.0	Mod.	Mod.	Mod.-High	D	30-50	10-20
lg-4	120a-4	than 20 9-18	4.2	1.4	Mod. Rapid	Mod. Rapid	High	B	60-85	0-10
lj-5	102	40-60	3.4	1.0	Mod. Rapid	Mod. Rapid	High	B	50-70	5-10
3a-2	109a, 109-4 109-5, 109-12, 132a-1, 132b	30-50	4.3	1.3	Mod. Rapid	Mod. Rapid	Mod.-High	A	60-80	0-10
3a-4	104-2, 110-2 111a-2, 111b-1, 111b-2, 120b-8, 134	30-50	1.1	0.7	Moderate Rapid	Moderate	Moderate	A	60-80	10-20
3a-5	130-2, 132a	30-50	3.1	1.8	Moderate	Mod. Slow	Moderate	B	70-90	5-20
3b-2	120a-4	10-20	4.1	2.9	Mod. Slow	Mod. Slow	High	C	90-95	--
3b-3	110-2, 111b-2,132a	Less than 20	2.9	1.0	Mod. Rapid	Mod. Rapid	Moderate	C	50-70	10-20
3d-2	109a, 109-12	30-50	2.7	1.5	Mod. Rapid	Mod. Rapid	Moderate	A	60-70	0-10
3d-3	101-2, 101, 104-2, 105-3, 109-4, 109-5, 109-10, 109b-1, 110-2, 110x-2, 111d-2, 113-1, 120a-2, 120b-10, 133b-2, 133c	21-60+	7.6	8.0	Moderate	Mod. Slow	Moderate	C	90-100	--
3d-4	104-2, 105-3 110-2, 110x-2	21-60+	8.8	8.0	Moderate	Mod. Slow	Moderate	C	80-100	--
3f-1	120d-1	20-40	1.9	1.5	Moderate	Mod. Slow	Low-Mod.	C	40-60	5-15

TABLE 14

SOIL HYDROLOGIC CHARACTERISTICS (Continued)

Soil No.	Landtypes	Depth to Bedrock	Detention in./ft.	Retention in./ft.	Infiltration	Permeability	Bedrock Penetration	Hydro-logic Group	Ground Cover	
									Vegetation & Litter %	Rock & Pavement
3g-1	110x-2, 111d-1,111d-2, 113-1,109b-1, 120b-10,133c	20	3.0	1.7	Mod. Slow	Mod. Slow	Moderate	C	80-100	--
3g-2	110-2	20	3.5	2.7	Moderate	Moderate	High	B	80-90	--
3g-3	109-10	20	4.3	1.9	Mod. Rapid	Mod. Rapid	High	B	80-90	0-2
5a-6	106-1,109-7, 109-11,130-1, 131-2,131-4, 133b-2,134-2	20-40	3.9	0.9	Mod. Rapid	Mod. Rapid	Moderate	B	60-80	5-20
5a-8	101-3,109-7, 109-11,130-1, 131,131-2, 131-4,132c,134-2	30-50	2.1	1.8	Mod.-Mod Slow	Mod. Slow	Low-Mod.	B	50-70	15-30
5b-5	109-7,109-11 130-1,131-2, 131-4,132a-1,132b, 132c,133b-2,133b-5 134-2	Less than 20	2.1	1.3	Moderate	Moderate	Moderate	C	40-60	15-30
5c-2	108-3	40-60	1.6	0.8	Mod. Rapid	Moderate	Rapid	B	60-90	5-15
5c-4	134-1	20-40	2.6	1.9	Mod. Rapid	Moderate	Moderate	C	70-90	5-15
5d-3	101-2,120b-8, 132b,133b-5	30-50	1.4	1.8	Mod. Rapid -Mod. Slow	Mod. Slow	Moderate	C	70-90	5-20
5f-2	101-2,105-3,131-1, 134,134-1	30-50	2.4	1.9	Mod.-Mod. Slow	Mod. Slow	Moderate	C	70-90	5-20
5f-5	120c-5,120c-7, 131,132b-1	20-40	1.9	1.1	Mod. Rapid	Mod. Slow	Moderate	C	50-70	10-20

TABLE 14

SOIL HYDROLOGIC CHARACTERISTICS (Continued)

Soil No.	Landtypes	Depth to Bedrock	Detenti-on in./ft.	Retention in./ft.	Infiltration	Permeability	Bedrock Penetration	Hydro-logic Group	Ground Cover	
									Vegetation & Litter %	Rock & Pavement
5g-2	120c-7	20-40	2.0	1.1	Mod. Rapid	Mod. Slow	High	C	50-70	5-10
5i-2	130-1	20-40	2.3	1.4	Mod. Rapid	Mod. Slow	Moderate	C	40-60	10-25
5i-3	132a-1,132c-2, 133b-1	30-60	8.4	5.2	Mod. Rapid	Mod. Slow	High	C	90-100	--
5j-3	120c-7,131-1	Less	2.2	1.2	Mod. Slow	Mod. Slow	Moderate	D	30-50	15-30
5k-3	132b-1,132c,133a-1	Less	1.4	1.6	Moderate	Mod. Slow	Moderate	D	40-60	5-15
5k-4	130-1, 133b-5	Less	2.2	1.8	Mod. Slow	Mod. Slow	Moderate	D	30-60	20-35
5n-1	122-1,122-5, 131-3,132a-1,132b-1,133b-1	Less than 20	2.2	1.4	Mod. Slow	Mod. Slow	Low	D	30-50	10-20
5s-3	101-3	60+	---	---	Slow	Slow	Low	D	70-90	0-5
5t-2	105-3,122-1,131-3	21-40	6.3	5.0	Moderate	Mod. Slow	High	C	30-100	10-20
5u-1	120b-6,120b-8 120c-12, 130-1 131, 131-1, 133a-1,134-1	Less than 20	2.2	1.4	Mod. Slow	Mod. Slow	Moderate	C	40-70	10-20
5u-2	120b-6,133a-1	20-40	3.1	1.9	Moderate	Moderate	Moderate	B	50-70	10-20
5v-1	120b-6,120b-8, 120c-12,131, 133a-1,134-1	10-20	3.1	2.9	Moderate	Mod. Rapid	High	B	60-70	30-40
5y-1	134, 134-1	30-50	2.6	1.6	Mod. Rapid	Moderate	Moderate	C	90-100	5-15
7a-3	120b-8,134	30-50	2.0	1.6	Moderate	Mod. Slow.	Moderate	C	90-100	0-5

TABLE 12

LANDTYPE CHARACTERISTICS AND HAZARDS

Landtype Symbol	Landtype Name	Characteristics			Surface Erosion Hazards			Mass Stability Hazards					Aval-anche	Traffic-ability	Revegetation	
		Slope %	Soil Composit-ion No %	Bedrock Outcrop %	Inherent Erosion Hazard	Cut & Fill Slope	Road Surface	Slides	Slump	Dry Creep	Road cut Slope	Road Fill Slope			Cut Slopes	Fill Slopes
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
109-1	Cryoplanated Ridge Land	5-25	3d-4 30 3a-5 40 5a-6 30	13-23	Mod-Low Mod	Mod Low-Mod	Mod-Mod High	Low	Low	-	Mod. Low	Mod Low	Mod Low	Poor	Mod	Mod
109-2	Cryoplanated Ridge Land	30-50	la-1 70 la-3 30	15-25	Mod-Mod High	Mod-Mod High	Mod	Mod.Low	Low	Mod.-Mod High	Mod. Low	Mod.	Mod.	Fair-Poor	Low	low
109-4	Steep	30-50	3d-3 55 3g-1 30 3a-1 15		High	High	Low	Low	Low	Mod. Low	Low	Mod. Low	Mod.	Good	Very	Mod
109-5	Cryoplanated Ridge Land	10-35	3a-2 50 3d-3 50		Low	Low	Low	Mod.Low	Low	Low	Low	Mod.	Low	Fair	Mod	Mod
109-7	Gryoplanated Ridge Land	15-60	5a-6 40 5a-8 40 5b-5 20	5-10	Mod-Mod High	Mod. Low-Mod High	Mod-Mod High	Low	Mod.Low	-	Mod. Low	Mod. Low	Mod. Low-Mod	Fair-Poor	Mod.Low	Mod
109-10	Cryoplanated Ridge Land	10-70	3d-3 50 3d-2 30 3g-3 20	5-10	Mod. Low-Mod High	Mod. Low-Mod High	Mod. Low-Mod	Mod.Low	Mod.Low	Mod.	Low-Mod High	Low-Mod High	Mod. Low	Good-Fair	Low	Low
109-11	Cryoplanated Uplands	5-30	5a-6 50 5a-8 30 5b-5 20	5-10	Mod. Low-Mod	Mod. Low-Mod	Mod-Mod High	Low	Low	Mod.	Low	Low	Mod. Low	Fair-Poor	Mod.	Mod
109-12	Cryoplanated Ridge Land	30-50	3a-2 20 3d-2 80	---	High Mod	High	High	Mod.Low	Low	High	Low	Mod.	Mod.	Fair	Very Low	Low
110-2	Cirque Basin	0-25	3a-4 50 3b-3 20 3d-3 30		Low Mod.	Low	low	Very Low	Low	Low	Very Low	Very Low	Low	Fair	High	High
110x-2	Scoured Cirque Basin	10-30	3d-3 40 3g-1 40 3J-4 20	20-33	Mod.	Mod. Low-Mod	Mod.Low	Low	Low	-	Low-Mod Low	Low Mod Low	Mod. High	Good Very-Poor	Mod	Mod

TABLE 12

LANDTYPE CHARACTERISTICS AND HAZARDS

Landtype Symbol	Landtype Name	Characteristics			Surface Erosion Hazards			Mass Stability Hazards					Aval-anche	Traffic-ability	Revegetation	
		Slope %	Soil Composit-ion No	Bedrock Outcrop %	Inherent Erosion	Cut & Fill Slope	Road Surface	Slides	Slump	Dry Creep	Road cut Slope	Road Fill Slope			Cut Slopes	Fill Slopes
111a-2	Weakly Dissected Glacial Trough Land	(1) 40-50	(2) 3a-4 100	(3) 0	(4) Mod.	(5) Mod.	(6) Low	(7) low	(8) Low	(9) Low	(10) Low	(11) Low	(12) Low	(13) Good	(14) Low	(15) High
111b-1	Moderately Dissected Glacial Trough Land	50-70	3a-4 30 1f-5 33 1g-3 40	5-10	High	High	Low	High	Low	Mod.	Low	Mod.	High	Good	low	Low
111b-2	Moderately Dissected Glacial Trough	40-50	3a-4 80 3b-3 20	5-10	Mod.	Mod.	Low	Low	Mod.	Low	Low-Mod	Low-Mod	Low	Fair	Mod.	Very High
111d-1	Steep Benchy Glacial Head-Lands	40-60	3d-4 60 3g-2 40	20a	Mod-Mod High	Mod-Mod High	Mod.High	Mod.Low	Mod.Low		Mod. Low	Mod.	High	Fair-Poor	Mod.Low	Mod.
111d-2	Steep Glacial Headlands	30-50	3d-4 40 3d-3 40 3g-1 20	5-10	Mod. Mod High	Mod.	Mod-Mod High	Mod.Low	Mod.Low		Mod. Low	Mod.	Mod. High	Fair-Poor	Mod.Low	Mod.
113	Rocky Ridge land	65-90	1g-3 40 RO 60	60	Very	Mod.	Low	Very High	Low	Mod.	Mod.	Low	High-Very High	Good	Very	Low
113-1	Rocky Ridge Land	40-70	3d-3 50 3a-4 13 3g-1 40	20630	Mod-Mod High	Mod.	Mod.Low	Mod.Low	Mod. low		Low-Mod. Low	Low-Mod. Low	High	Good-	Low	Low
120a-2	Weakly Dissected Mountain Slope Land	20-60	3c1-3 80 3g-1 10 3d-4 10	0-5	Mod. Mod.Hig	Mod.	Mod. Low-Mod High	Mod.Low	Mod.		Low-Mod Low	Low-Mod Low	Mod. Low	Good-Poor	Mod.	Mod.
120a-4	Weakly Dissected Mountain Slope Land	30-60	33-5 70 3b-2 20 1g-4 10	5-10	Mod.	Mod. Low Mod.	Mod-Mod High	Low	Mod.Low		Mod. Low	Mod. Low-Mod	Mod. Low	Poor	High	High
120b-6	Moderately Dissected Mountain Slope Land	45-65	5u-2 40 5v-1 80	5-15	Mod-High Mod-High	Mod.	Low	Low	Low	Low	Low-Mod Low; Mod-Low	Mod. Mod Low	Low	Good-Poor	Low	Mod.

ALLUVIAL FAN LAND -
DEEP LOAMY SKELETAL AND FINE LOAMY SOILS
Map Symbol 105-3

Typical Location. Little Creek.

Management Zone. Intermediate.

Extent. Acres: 3,039 Percent of Area: 0.8

Topography. Slope Gradient: 5-30%; Aspect: West, North, and South; Elevation: 5,000' - 5,500'.

Geomorphic Features. This landtype is a series of adjoining cone-shaped deposits of alluvium. These fans are depositions on a valley floor and form toe slopes to the steeper upper slopes from which they have received their materials. Since deposition, streams have dissected these fans.

Bedrock Characteristics. Granitic and basalt rocks mixed, and are generally at depths greater than 10 feet.

Vegetation. This landtype is timbered. The overstory species include grand fir, Douglas-fir, lodgepole pine, Engelmann spruce, and ponderosa

pine. The understory species include snowbrush, spiraea, vaccinium, honeysuckle, pinegrass, and Prince's pine.

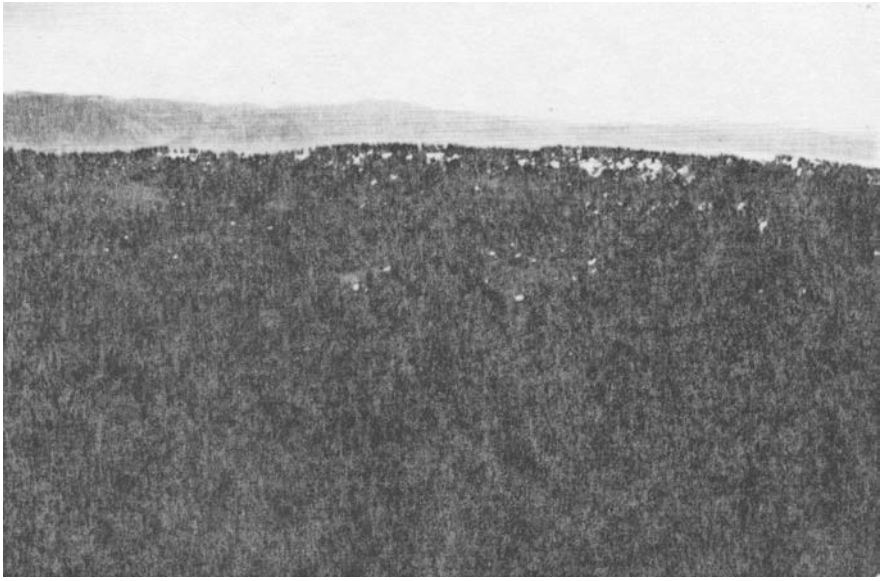
Soils. The predominant soil is 3d-3. It is scattered on these slopes. It has a thick dark fine sandy loam to a gravelly loam surface with a gravelly loam to gravelly sandy loam subsoil. At 20 to 40 inches a gravelly sandy loam substrata is reached. Associated with this soil is a 3d-4 soil. It has a thick dark silt loam to fine sandy loam surface with a silt loam to fine sandy loam subsoil. At 30 to 40 inches, the gravelly loam to gravelly sandy loam substrata is reached. On the lower benches, 5f-2 soil is located. It has a thick dark silt loam surface with a deep silty clay loam subsoil. For these soils, bedrock is usually over 6 feet from the surface.

Hydrology. Annual precipitation on these lands ranges between 28 and 42 inches. Between 20 and 45% of this is yielded to streamflow, nearly all as subsurface flow. Less than 20%, and most generally no surface runoff, is produced from high intensity storms.

Management Qualities. The inherent erosion hazard is moderately low to moderately high. Surface erosion hazard for road cut and fill slopes is moderately low to moderate and for road surfaces is moderately low to moderately high. Slump hazard is moderately low. Mass stability hazard for cut and fill slopes is moderately low. Road trafficability is good to poor due to the variability of the soils. This unit is one of the best timber producers of the district. Activities on this unit, with proper location and design planning, shouldn't present much impact on the land.

Management Evaluation.

CRYOPLANATED RIDGE LANDS -
MODERATELY DEEP, FINE LOAMY SOILS
Map Symbol 109-1



Typical Location. Head of Lick Creek.

Management Zone. Crest.

Extent. Acres: 6,037 Percent of Area: 1.6

Topography. Slope Gradient: 5-30%; Aspect: East and West; Elevation: 6,300' - 8,000'.

Geomorphic Features. These lands are characterized by smooth, gentle slopes at high elevations. They commonly occupy the tops of ridges and have a scattered overstory. These lands are the result of climatic change brought about by adjacent strongly glaciated areas, and have been formed by the processes and effects of permanent snow and ice field action. Small, weak cirques are present on the unit. Nivation, freezing and thawing, wetting and drying, make mass wasting the chief process by which materials are moved downslope.

Bedrock Characteristics. The basalt bedrock is well to extremely well fractured, slightly weathered to moderately hard, somewhat weathered.

Vegetation. The present vegetation consists of subalpine fir, white-bark pine, lodgepole pine, and Douglas-fir, with an understory of sagebrush, penstemon, violet, buckwheat, lupine, needlegrass, and fescue. The tentative habitat type is whitebark pine/subalpine fir.

Soils. The dominant soils are 3d-4 (30%), 3a-5 (40%), and 5a-6 (30%). Rock outcrop ranges from 10 to 20%. The 3d-4 soils have very fine sandy loam to silt loam surfaces over very fine sandy loam to silty clay loam subsoils. Soil depth ranges from 21 to 44 inches. The 3a-5 soils have gravelly silt loam to silt loam surfaces over gravelly silt loam to silt loam subsoils and depths range from 22 to 47 inches. The 5a-6 soils have silt loam surfaces over silt loam to gravelly loam subsoils and range in depth from 22 to 36 inches.

Hydrology. Precipitation on this landtype is between 20 and 45+ inches. A large amount of this (55-75%), is yielded to stream flow via both overland flow and subsurface runoff. Concentrations of subsurface flow are likely to occur in the soil mantle. On disturbed or open portions of the unit, as much as 20 percent of a high intensity storm may run off as overland flow.

Management Qualities. The inherent erosion hazard on these lands is moderately low to moderate. Surface erosion hazards for road cut and fill slopes are moderately low to moderate, and moderate to moderately high for road surfaces. Natural mass stability hazards are low, and road mass stability hazards are moderately low. Trafficability is poor. Productivity for timber is very low, and reforestation limitations are very severe, due mainly to climatic conditions and high evapo-transpiration. Much of this landtype has been overused by livestock. There is a need for protection from grazing, and in some cases, restoration. Effective physical rehabilitation can be realized because of the high fertility of the soils and good moisture holding capacity. Shortness of growing season is the only limitation to the success of rehabilitation measures.

Management Evaluation.

Map Symbol 111a-1
Weakly Dissected Glacial Trough Land
Shallow and Moderately Deep Skeletal Sandy and Loamy Soils

Landtype. Characteristics: These lands occupy the sideslopes of U-shaped troughs, typical of alpine glaciated mountains. Slopes have been over-steepened and the V-shaped fluvial canyons have been altered to U-shaped valleys by the ice action of glaciers. Drainage patterns are typically parallel as compared to the dendritic pattern of the Fluvial Lands. Slopes are smooth and weakly dissected, The slopes of this landtype are southerly, mostly non-timbered or scattered small stands, convex to straight, have a 50 to 70 percent gradient, 500 to 2000 feet long and are mapped at elevations above 7500 feet. The soils have dark colored surfaces, with sandy and loamy skeletal families, 15 to 60 inches deep. The soils are underlain by slightly to moderately well weathered granite, which is massive to well fractured or masked.

Soils: The dominant soils on this landtype (IFBD-5, IFBA-5) are shallow and deep and have an organic layer zero to one inch thick. The surface soil is a dark brown, gravelly coarse sandy loam to a gravelly loamy sand, with 15 to 25 percent fine gravel and zero to five percent rock. The subsoil is a dark yellowish brown, gravelly coarse sandy loam to cobbly coarse sandy loam, with 15 to 25 percent fine gravel and 25 to 40 percent rock. These soils are found on all sideslope positions. The shallow (IFBD-5) is on upper and mid slope positions associated with the steepest gradient. The deep (IFBA-5) is found on mid and lower slope positions and in swales or other areas of soil accumulation. The other soils (JCAJ-l) are similarly described with the exception that they are shallow, with loamy coarse sand textures and less than 15 percent coarse fragments in the profile. These soils are found on upper sideslopes, ridge tops and near rock.

Vegetation: The slopes of this landtype are not heavily vegetated. Timber production is rated as very low with the following habitat types represented: subalpine fir/whitebark pine, subalpine fir/elk sedge, and brush/grass communities not identified as to habitat type. Vegetative ground cover for the landtype ranges from 40 to 70 percent. Forest crown density is less than 5 to 20 percent and brush crown density ranges from 15 to 30 percent.

Hydrology: Annual precipitation received on these landtypes, which is predominantly in the form of snow, ranges between 35 and 45 inches. Approximately 20 to 30 inches of this amount is yielded annually.

Overland flow is rare on undisturbed sites. On those slopes heavily impacted by stock animals, overland flow and accelerated erosion are evident. Deep seepage and subsurface flow are the prime modes of water yielded from the slopes. Subsurface flow moves uniformly downslope to accumulate in greatest quantity within the lower deeper soils. Natural interception of subsurface water by the parallel dissections occurs and is evenly distributed on the lower bordering landtype (usually 104). The moderate to rapid response to water input is due primarily to the moderate snowmelt period and rapid transmission of moisture through the soil horizon.

Management Qualities: The steep sideslopes of this landtype and the likelihood of intercepting subsurface waterflow are the major hazards to be considered on these units.

Roads. Construction materials in these lands are of good quality; slightly weathered and well graded. Mass stability hazards, however, tend to offset this benefit. Surface erosion hazard for natural slopes as well as cut and fill slopes is high. Mass stability hazards for cut and fill slopes are high. These factors combined with the possibility of intercepting subsurface flow, makes water and sediment handling definite engineering and management problems. The most suitable position with the least expected impact for these hazards would be the upper one-third of slopes. Trafficability is good to very good.

Wood. Timber productivity potential is rated as very low. The slopes dominantly have a brush/grass cover. There are small scattered pockets of subalpine fir/elk sedge in semi-protected areas on sideslopes, and subalpine fir/whitebark pine on the higher more exposed positions. Limitations to reforestation are severe and are related to severe climate conditions and water-holding capacity.

Water. Reduction in vegetative cover by excess grazing or other means will lead to an increase in overland flow and accelerated erosion. Deep road cuts into the toes of these slopes will intercept a moderate volume of subsurface flow during spring snowmelt. This intercepted flow can be easily concentrated to very erosive quantities unless special dispersing drainage is accomplished. Also, widespread removal of subsurface water will reduce the runoff period.

Forage. The potential production for this landtype is 100 to 1000 pounds per acre per year of usable dry forage. The lower yields are associated with the shallow soils on mid, upper and ridge positions. The low rates are related to the shallow, coarse textured oils and their low water-holding capacity. The higher rates are associated with deeper soils and a somewhat more moist micro-climate and a higher water-holding capacity.

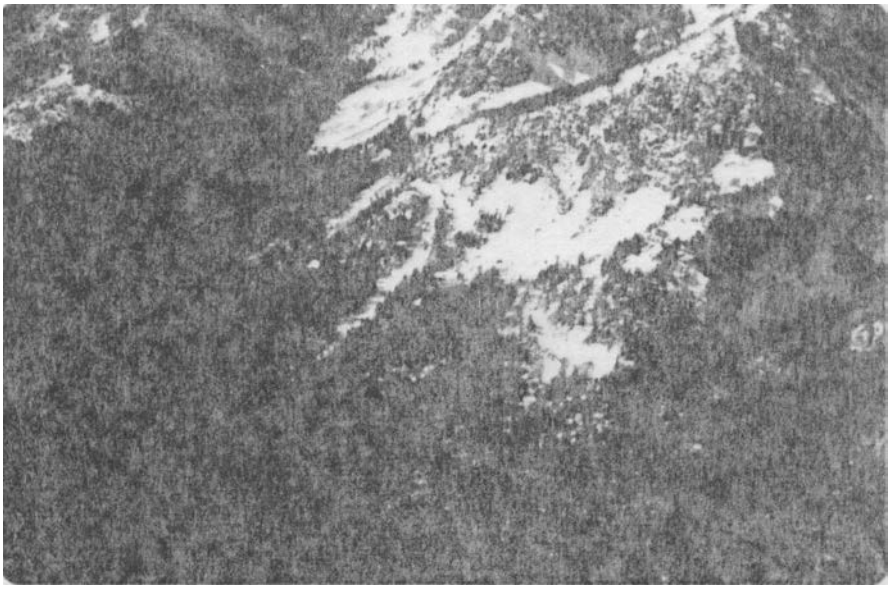
Recreation. These lands are an important part of the high value dispersed recreation areas associated with Glaciated Lands. They function as a scenic backdrop at the upper ends of glacial troughs. Trail construction would have problems similar to roads. Seasonal maintenance would be required to remove rocks, debris, and sediment. Trafficability would be good to very good.

Management Evaluation:

WEAKLY DISSECTED GLACIAL TROUGH LAND - DEEP FINE LOAMY AND LOAMY SKELETAL SOILS
Map Symbol 111a-2

Typical Location. Upper Hornet Creek.
Management Zone. Intermediate.
Extent. Acres: 1,392 Percent of Area: 0.3

Topography. Slope Gradient: 40-50%; Aspect: All; Elevation: 5,500' - 6,500'.
Geomorphic Features. These lands occupy the side slopes of the U-shaped troughs that are typical of alpine glaciated mountains. Slopes have been oversteepened and the V-shaped alluvial canyons have been altered to the U-shape by the ice action of the glaciers. The drainage patterns on these units are typically parallel, as compared to the dendritic pattern found in the Fluvial Lands. This landtype is smooth and weakly dissected by parallel drainages spaced greater than 1,500 feet apart and entrenched at depths ranging from 10 to 30 feet. Drainages spaced closer than 1,500 feet are less than 10 feet deep, and drainages greater than 3,000 feet may be deeper than 30 feet. The soil mantle is 2 to 4 feet deep and contains large volumes of angular coarse fragments, 3 to 8 inches in diameter.



Bedrock Characteristics. The bedrock on this unit is both granite and Columbia River Basalt. The basalt is well fractured and is hard and unweathered. Depth to basalt bedrock is from 30 to 50 inches. The granitic bedrock is moderate to well fractured and is hard to moderately hard and nonspalling. Rock outcrop is evident on 5 to 10% of the landtype, and in addition, 5% of the unit is covered by large granite boulders. The soil depth to bedrock varies from 2 to 4 feet in the remaining area. The mineralogy of the soils near the geologic contact and where there are colluvium deposits, will be mixed.

Vegetation. Subalpine fir, Douglas-fir, lodgepole pine and whitebark pine make up the overstory on this landtype, with a crown cover of 5 to 10%. The undergrowth is composed of low huckleberry, wheatgrass, needlegrass, and elk sedge. Total ground cover for the unit is from 60 to 80%. The habitat type is subalpine fir/whortleberry.

Soils. Soils on this unit are moderately deep, light colored, cobbly with sandy loam textures throughout. Parent material is andesite and basalt. Representative soil on this unit is 3a-4 (100%).

Hydrology. Approximately 25 to 40% of the 30 to 40 inches of precipitation falling on this type eventually becomes stream flow. Very little or none of the precipitation from high intensity storms runs off on the soil surface.

Management Qualities. Productivity for timber is low. The inherent erosion hazard is moderate; the surface erosion hazard for cut and fill slopes is moderate. There is a moderate mass stability hazard of cut slopes in this landtype. The avalanche hazard for the unit ranges from moderately low to moderate. Deep percolation of moisture and the return of water as subsurface flow would be the rule, because of the fractured nature of the bedrock. The engineering characteristics of the area are favorable in most respects due to the moderate stability of the soil mantle and bedrock.

Management Evaluation.

WEAKLY DISSECTED GLACIAL TROUGH LAND –
MODERATELY DEEP AND DEEP COARSE AND FINE LOAMY SOILS
Map Symbol 111a-3

Typical Location. East Pine Creek, Rush Creek.

Management Zone. Crest and Intermediate.

Extent. Acres: 1,701 Percent of Area: 1.4

Topography. Slope Gradient: 10-45%; Aspect: Dominantly East and West; Elevation: 5,500' - 7,400'.

Geomorphic Features. These lands occupy the side slopes of the U-shaped troughs that are typical of alpine glaciated mountains. Slopes have been oversteepened and the V-shaped alluvial canyons have been altered to the U-shape by the ice action of the glaciers. The drainage patterns on these lands are typically parallel as compared to the dendritic pattern found in the Fluvial Lands. This landtype is smooth and weakly dissected by parallel drainages spaced from 500 to 1,000 feet apart and entrenched at depths ranging from 10 to 30 feet. The mantle is 1 1/2 to 4 feet deep and contains considerable volumes of coarse fragments, ranging from gravel size to 10 to 12 inches.

Bedrock Characteristics. There are bedrock outcrops on 5 to 10% of the area, plus 5 to 10% of the surface is covered with large boulders. Bedrock is mainly basalt, with some granite. Fracturing ranges from slightly fractured to extremely well fractured. Weathering ranges from moderately well to weakly weathered for the granite and moderate to hard, unweathered for the basalt. Depth to bedrock is as shallow as 13 inches and ranges to depths of 4 feet or more.

Vegetation. Tree species are dominantly Douglas-fir with some sub-alpine fir and lodgepole pine. Ground cover consists of low whortleberry, wheatgrass, pinegrass, elk sedge, and stipa. Ground cover density ranges from 80 to 100%. Crown cover for the overstory is from 20 to 35% and for the understory from 5 to 40%. Habitat types are Douglas-fir/pinegrass and subalpine fir/whortleberry.

Soils. Dominant soils on this landtype are 1f-1 (50%), lf-4 (30%), and lg-2 (20%). These soils have a dark colored surface horizon and a light subsoil. The lf-4 and lg-2 soils have dark colored loam surface textures with very fine sandy loam to sandy loam subsoil textures. Rock fragments range from 5 to 30% throughout. The lf-1 soil has a gravelly sandy loam surface and a loamy sand subsoil with 10 to 30% gravel and rock fragments throughout the profile. The lg-2 soil is shallow to bedrock (13 inches), the 1f-1 and lf-4 are over 40 inches.

Hydrology. Subsurface flow is dominant, with concentration time slow. Subsurface flow rates are fast. There is very little overland flow in this unit. There is some loss of soil moisture to the bedrock.

Management Qualities. The inherent erosion hazard is moderate to moderately high. The surface erosion hazard for cut and fill slopes is moderate to moderately low. There is a moderate mass stability hazard of cut slopes in this landtype. Because of the fractured nature of the bedrock, there is fairly deep moisture percolation and much of the water is returned as subsoil flow. The engineering characteristics of this landtype are favorable in most respects. These units are small in area over the District but do provide cover and escape routes for big game animals.

Management Evaluation.

STEEP CIRQUE HEADLANDS -
MODERATELY DEEP FINE LOAMY SOILS
Map Symbol 111d-2

Typical Location. Side slopes of Cottonwood Basin.

Management Zone. Crest.

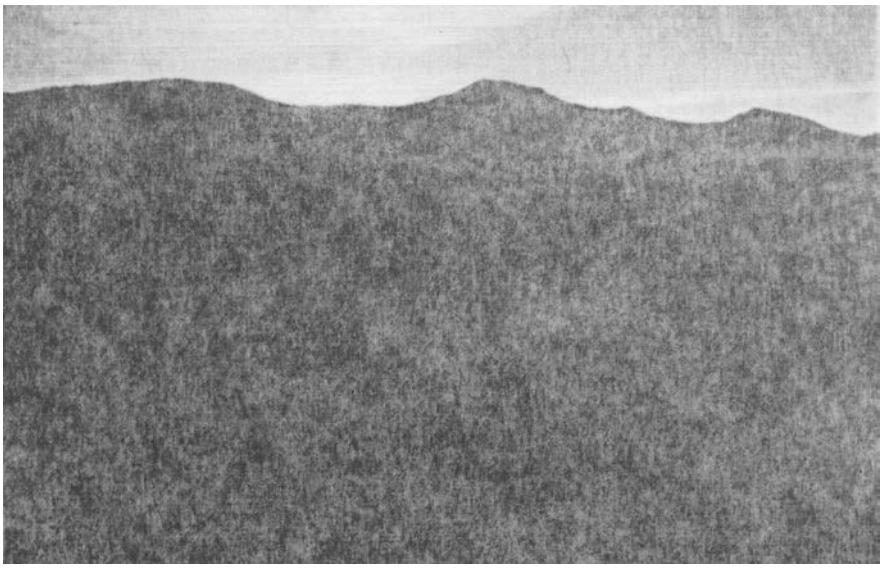
Extent. Acres: 1,919 Percent of Area: 0.5

Topography. Slope Gradient: 30-50%; Aspect: West, Southwest, and Northwest; Elevation: 6,500' - 8,100'.

Geomorphic Features. This landtype is the concave-shaped, moderate to steep cirque walls located above the cirque basins. The basalt flow beds dip with these slopes which don't express a benchy micro-relief. These headwalls have many very shallow parallel dissections and contain areas of talus that is moving downslope.

Bedrock Characteristics. The basalt bedrock is well to extremely well fractured and weakly weathered. Less than 10 percent of these lands have exposed bedrock.

Vegetation. The predominant vegetation consists of grassland parks with sagebrush, grass and forb cover. Scattered stringers and clumps of subalpine fir, Engelmann spruce with a low huckleberry understory are located in the draws and north aspect slopes.



Soils. A 3d-4 soil is representative of the sagebrush slopes. It has a thick dark very fine sandy loam to silt loam surface and a very fine sandy loam to silt loam subsoil. Depth to bedrock is 21 to over 40 inches. Scattered on the slopes is a 3d-3 soil. It has a thick dark very fine sandy loam surface and a gravelly fine sandy loam subsoil. Depth to bedrock ranges from 30 to 50 inches. A 3g-1 soil is also scattered on the upper slopes. It has a thick dark surface with a gravelly very fine sandy to gravelly silt loam profile. Bedrock is less than 20 inches.

Hydrology. Annual precipitation ranges between 34 and 42 inches, with about 45 to 65% of this yielded to streamflow. A decreased amount of exposed bedrock and generally deeper soils make this unit less subject to overland flow than on the 111d-1 landtype. Water yield ranges between 45 and 65 percent with the majority of stream flow coming from subsurface flow. Up to 10 percent of a high intensity storm will be yielded as surface runoff on undepleted portions of the unit and more will occur on disturbed or heavily grazed portions.

Management Qualities. The inherent erosion hazard is moderate to moderately high. Surface erosion hazard for road cut and fill slopes is moderate and for road surfaces is moderate. Slump hazard is moderately low. Mass stability hazard for cut slopes is moderately low and for fill slopes is moderate. Road trafficability is fair to poor. This unit has early snow cover.

Management Evaluation.

ROCKY RIDGE LAND -
MODERATELY DEEP AND SHALLOW LOAMY SKELETAL SOILS
Map Symbol 113-1

Typical Location. Council Mountain.

Management Zone. Crest.

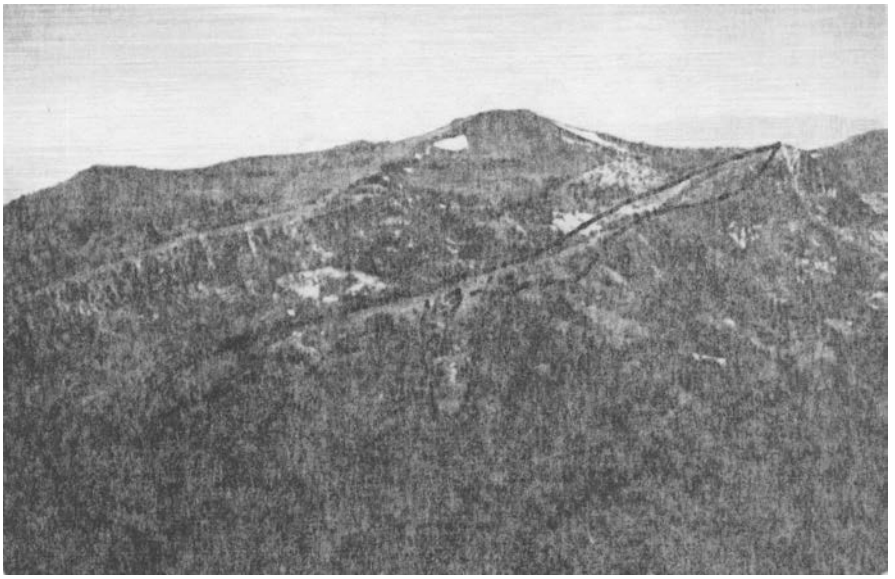
Extent. Acres: 640 Percent of Area: 0.2

Topography. slope Gradient: 40-70%; Aspect: East, North and South; Elevation: 6,500' - 8,100'.

Geomorphic Features. This landtype consists of the highest ridges, upper slopes and extremely rocky upper spur ridges. This unit occurs at the highest elevations of the glaciated lands. Included in this unit are cirque headwalls, rocky cirque headlands, and small areas of dissected glacial trough lands. Talus slopes are common.

Bedrock Characteristics. Basalt is predominant. It is well to extremely well fractured and weakly weathered. Some granitic rocks are exposed; 20 to 30 percent of the unit has exposed bedrock.

Vegetation. The major portion of this unit is sagebrush and grass. The scattered stands of timber consist of Engelmann spruce, subalpine fir, and lodgepole pine.



Soils. A 3d-3 soil is predominant on this landtype. It has a thick dark surface with gravelly sandy loam textures. The subsoil is a gravelly sandy loam. Bedrock usually is 21 to 40 inches deep. A 3a-4 soil is found with the 3d-3 soil but differs from it in having a thin dark or lighter colored surface. Next most common soil to the 3d-3 soil is a 3g-1 soil. It has a thick dark gravelly sandy loam surface and a thin gravelly sandy loam subsoil. Bedrock is less than 20 inches deep.

Hydrology. This type is one of the highest water producers on the District, producing just slightly more (55-85%) than the 113 landtype. It receives between 38 and 45 inches of precipitation annually. Stream-flow from this type comes from both surface and subsurface flow. On some portions of the unit, talus slopes and well fractured bedrock provide for good infiltration of high intensity storms, while where these conditions do not exist, as much as 50% of a high intensity storm may run off as overland flow.

Management Qualities. The inherent erosion hazard is moderate to mod-erately high. Surface erosion hazard for road cut and fill slopes is moderate and for road surfaces is moderately low. Slump hazard is moderately low. Mass stability hazard for cut and fill slopes is low to moderately low. Road trafficability is good to fair. This unit has early snow cover.

Management Evaluation.

MODERATELY DISSECTED THICK MANTLED MOUNTAIN SLOPE LAND
Map Symbol 120b-2

Location - West Mountain, No Business Mountain

Management Zone - Intermediate

Extent - Acres: 4391
Percent of Area: 3.0%

Topography - Slope Gradient: 30-40%
Aspect: East
Elevation: 5,000' - 7,000'

Geomorphic Features - These lands are dissected mountain slopes which are incised by drainages spaced generally between 500 and 1,500 feet apart and entrenched in the slopes at depths ranging from 10 to 30 feet. Drainages spaced at distances greater than 1,500 feet may be deeper than 30 feet and drainages spaced closer than 500 feet may be less than 20 feet deep. The mantle thickness on this unit is greater than on Land Type 120.

Bedrock Characteristics - The granitic bedrock is well fractured and moderately hard, somewhat weathered.

Vegetation - Dominant trees are grand fir, Douglas-fir, Engelmann spruce, and larch. The understory includes twinberry, alder, tall huckleberry, mountain maple, meadow rue, fern, and sedge. Ground cover density ranges from 90 to 100 percent. Overstory crown cover density rnges from 50 to 60 percent and 50 to 60 percent for the understory.

Soils - The dominant soils on this land type are 3a (70%) and 3b (30%). Rock outcrop i3 10 percent. The 3a and 3b soils have a loam to fine gravelly loam surface over a sandy loam to fine gravelly loam subsoil. The 3b soil is stony throughout. Soil erodibilities are moderately low to moderate.

Management - Qualities The inherent erosion hazard on this land type is moderately low to moderate. Engineering characteristics are generally favorable on this unit. Road cuts in excess of 25 to 30 feet may uncover seeps and subsurface flows. This will weaken cut slopes and increase road maintenance costs. Mass stability hazards are generally moderately low. Timber production on this land type appears to be among the highest on the District. Herbage production is moderate.

Management - Evaluation